COMMONWEALTH *of* VIRGINIA

June 27, 2002

It is our pleasure to provide you with a unique document that can serve as a critical tool in leveraging the individual efforts of agencies and organizations working to manage and protect Virginia's natural resources.

The *Natural Resource GIS Application and Data Analysis* represents the commitment of seven natural resource agencies and organizations, with support from the Virginia Geographic Information Network, to provide a thorough examination of geographic information system (GIS) applications and data requirements across these agencies in Virginia.

Working in collaboration, sharing information and plans, these organizations have identified opportunities to leverage and combine individual efforts into focused investments that will provide the greatest collective benefit across all the organizations. This effort will significantly expand our ability to meet our mandated responsibilities by producing more and better information and data, which is critical to effective management and protection of our natural resources.

The *Natural Resources GIS Application and Data Analysis* will be an ongoing effort, ensuring that we will continue to realize the greatest benefit from our information, data, and technology investments.

We hope you will find this report interesting and informative.

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

George Newstrom
Secretary of Technology

Virginia's Natural Resources Workgroup

Evaluating Collective Spatial Data Needs and Priorities Through an Application Oriented Approach
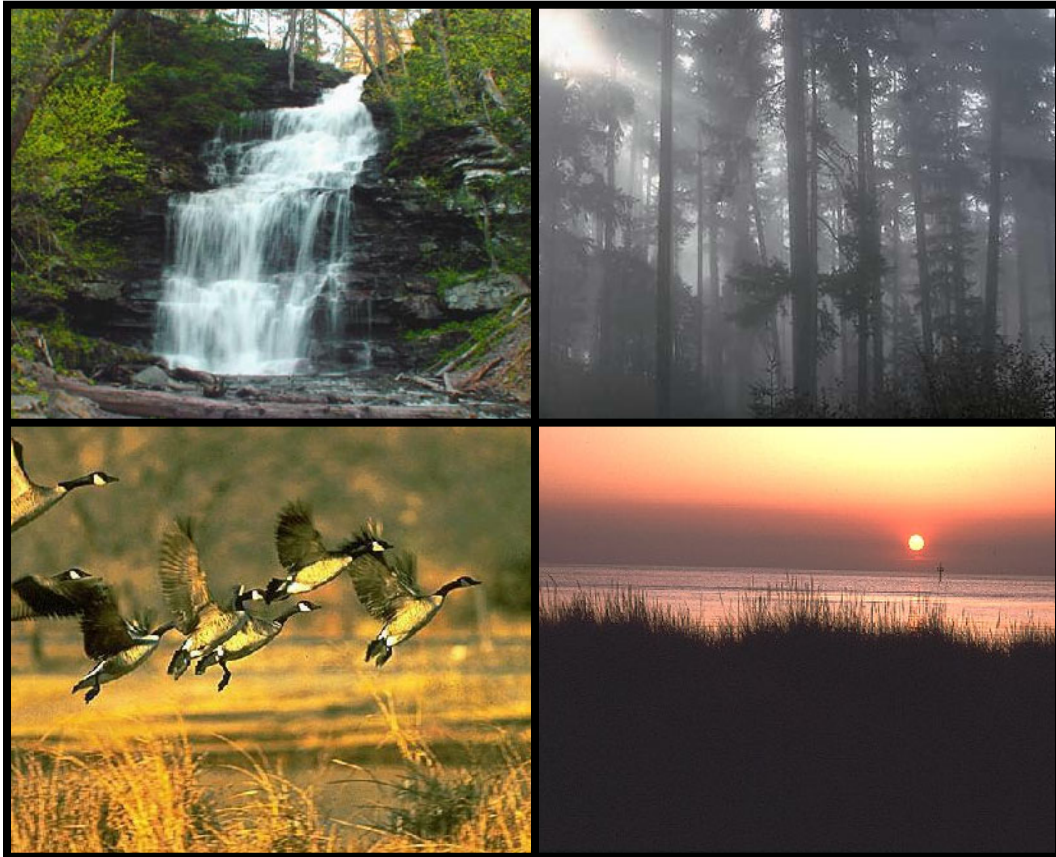
Executive Summary

Virginia's Natural Resources Workgroup:
Evaluating Collective Spatial Data Needs and Priorities
Through an Application Oriented Approach

In November 2000, the Virginia Geographic Information Network (VGIN) organized the Virginia Natural Resources Managers Work Group to share information across the agencies about GIS related activities and to work collaboratively on issues. Identifying the full spectrum of natural resources GIS applications and the "demand" for spatial data to support these applications has been a priority for the Work Group.

This report outlines the Work Group's collective efforts to identify spatial data priorities based on the "application demand" of the natural resources agencies. The first section of the paper outlines the procedures used to identify and evaluate the spatial data needs of the Work Group. Each of the agencies' operational GIS applications are identified, as are the spatial data layers required to support these applications. The paper documents 62 operational GIS applications supported by 90 spatial data layers. The "demand" for spatial data required to support the operational GIS applications is then evaluated and prioritized.

The second section of the document identifies the status of high priority spatial data resources in the Commonwealth. The Natural Resources Work Group's recommendations to VGIN for action on the priority data layers (listed by priority rank) are summarized as follows:

1. <u>Hydrography</u> – The Natural Resources WG agreed that acquiring higher resolution hydrography is the highest priority, given the collective application needs of the group. The group also identified the National Hydrology Dataset (NHD) as an appropriate model to support existing and future applications.

2. <u>Watershed Boundaries</u> – The Natural Resources WG concurred that DCR's data development efforts are sufficient to support most applications and that currently, there is no need to enhance this data resource.

3. (tie) <u>Land Use</u> *and* <u>Land Cover</u> - The Natural Resources WG members concurred that all of the active state and federal agencies currently working on the generation of land use or land cover data in Virginia should present their mapping initiatives at a State User Group Meeting. This meeting should serve to educate users about the available land use and land cover data options in Virginia, and should outline the advantages, disadvantages, and appropriate applications associated with each of these data options.

5. <u>Wetlands</u> – The Natural Resources WG members agreed that the existing level of detail in the NWI is sufficient to support most applications and that currently, there is no need to enhance the scale of this data resource. Members of the group

expressed interest in updating the NWI data. The cost of updating the NWI quads is estimated by the U.S. Fish and Wildlife Service to be approximately $1,000 – $1,500 / quadrangle. However, no formal recommendations have been made at this time.

6. <u>Elevation</u> – The Natural Resources WG agreed that currently there is no additional action that should be taken to support the development of a statewide, enhanced elevation database. This was due, in part, to the fact that the group recognizes that the generation of elevation data is expensive

7. <u>Jurisdictional Boundaries</u> – The Natural Resources WG concurred that DCR's new database (1:24,000) is sufficient to support most applications and that currently, there is no need to enhance this data resource.

8. (tie) <u>Riparian Forest Buffers</u> – The Natural Resources WG discussed options for developing a statewide riparian forest layer. The Department of Forestry may develop a statewide riparian forest buffer layer if there are sufficient application demands for this data product. This layer would be derived from DOF's Forest Resource Assessment Program.   No conclusion was reached by the Natural Resources WG.

8. (tie) <u>Soils</u> – The Natural Resources WG members agreed that, when available, the USDA's SSURGO soils will be sufficient to support most applications. While the SSURGO database is being developed by the federal government, state funding could facilitate the generation and maintenance of this data set. However, the group recommended that due to limited resources and higher priorities, no action is necessary to support the development of soils at this time.

10. (tie) <u>Census Data</u> - The Natural Resources WG agreed that the existing level of detail is sufficient to support most applications and that currently, there is no need to enhance this data resource.

10 (tie) <u>Land Ownership and 12. Parcel boundaries</u> (collectively considered to be cadastral data) - It is anticipated that the VBMP will provide an important catalyst to support the development and maintenance of parcel data (both land ownership and parcel boundaries) across the Commonwealth. A vital component in this process, however, is the development of standards and guidelines to support local efforts to consistently develop value added data products, which includes cadastral information (as well as hydrography, road centerlines, etc.).

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[1] As of June 30th, John will leave VGIN for a position in Ethiopia. Any questions after this time should be directed to either Bill Shinar or Cara Kaufman.
[2] Other representatives from DEQ and DGIF have also attended the Natural Resources Work Group meetings.

I. Introduction and Overview

In November 2000, the Virginia Geographic Information Network (VGIN) organized the Virginia Natural Resources Managers Work Group (hereafter referred to as the Natural Resources WG). The Natural Resources WG membership includes the geographic information system (GIS) managers for six natural resources agencies, a university research laboratory, which supports natural resource agencies, and the VGIN Assistant Coordinator for state agencies.

A. Natural Resources Work Group Members

The members and their organizations include:

Agency	Representative	Secretariat
Chesapeake Bay Local Assistance Dept. (CBLAD)	Michael Vojta	Natural Resources
Dept. of Conservation and Recreation (DCR)	Karl Huber	Natural Resources
Dept. of Environmental Quality (DEQ)	Michael Murphy	Natural Resources
Dept. of Forestry (DOF)	Mindia Brown	Commerce/Trade
Dept. of Game and Inland Fisheries (DGIF)	Dave Morton	Natural Resources
Marine Resources Commission (VMRC)	Kevin Curling	Natural Resources
Virginia Institute of Marine Sciences (VIMS / College of William and Mary)	Marcia Berman	Education
Virginia Geographic Information Network (VGIN)	John McGee	Technology

The Natural Resources WG is chaired and led by Marcia Berman of VIMS. John McGee, the VGIN Assistant Coordinator, provides the committee with administrative and logistical support.

B. Work Group Mission

The VGIN Natural Resources WG was established to encourage a positive partnership between VGIN and leading GIS managers among the state's natural resources agencies. In doing so, the Natural Resources WG is working to provide a unified representation regarding GIS issues pertinent to the ongoing business of natural resources management within the Commonwealth. The Natural Resources WG works closely with VGIN to address issues, which embody the full breadth of GIS development, standards, and maintenance relevant to all agencies charged with the protection and management of the Commonwealth's natural resources. The Natural Resources WG seeks to build consensus regarding these issues among the participating membership, and reports directly to VGIN with recommendations. The Natural Resources WG also focuses on specific tasks, and is called upon by VGIN to address specific issues on an as needed basis.

II. The Natural Resources Agencies' "Demand" for Spatial Data/GIS

Each of Virginia's natural resources agencies has responsibilities assigned to it by the Governor, General Assembly or the Federal Government.   Each individual agency translates these responsibilities into specific activities, products and services. Geographic information system (GIS) software and geocoded (spatial) data are tools and resources that natural resources agencies rely on to produce effective natural resources products and services and meet their mandated responsibilities. <u>In order for the Natural Resources WG to effectively evaluate the spatial data needs and priorities of Virginia's natural resources agencies, it is necessary to identify and understand the products and services (business applications) that ultimately are the sources of the demand for spatial data and GIS</u>.

The Natural Resources WG identified and measured the demand for spatial data and GIS by identifying the business application/spatial data "landscape" both within and across the participating organizations. The process initially involved several steps:

- **Agency GIS Application (product/service) Inventory**: Each agency was asked to identify the business applications within the agency, which were supported by GIS and spatial data, and list the data required by the application (Appendix A).

- **The Application Matrix**: The application/data inventories of all the agencies in the Natural Resources WG were collectively compiled, and listed on a spreadsheet in the form of a GIS Application / Data Matrix (Appendix B);

- **Agency Follow-up Survey**: Digital follow-up surveys were distributed to each Natural Resources WG Member. WG Members were asked for more detailed information about each GIS business application. This information included the origin of the application's original mandate (i.e. federal, state, internal, etc.) and the reporting/output schedule of the application. In some cases agencies use spatial data resources that are less than ideal for a specific application or objective. Therefore, the follow-up survey also asked agencies to identify the applications, which could be improved by having access to better data. Furthermore, Natural Resources WG organizations were asked to identify the specific data layers which, if improved or developed, could more effectively support the application (Appendix C).

III. The GIS Application/Spatial Data "Landscape" in Virginia

With the initial documentation of GIS applications in each agency, the responses were entered into a spreadsheet resulting in a matrix of applications related to spatial data resources. Applications, the responsible agency, and application specifics (i.e. mandate) were listed along the X-axis. The spatial data resources and related information (data type, maintaining organization, etc.) critical to each application were identified along the

Y-axis. In the matrix each spatial data layer is identified by its common name and the agency, which is responsible for maintaining the layer. To the extent possible, applications and data were grouped in the matrix, by theme (See Appendix D for a list of Applications listed by Theme). The matrix provides a means of analyzing applications and data both "within and across" Virginia's natural resources agencies.

IV. The Natural Resources GIS Application Summary

Applications were evaluated and summarized based on assigned theme, responsible agency, and mandate.

A. Applications by Theme

The Natural Resources WG members identified 62 operational applications. In some cases additional applications that are in the planning and development stages were identified but not included in the matrix. The application themes (and number of operational applications assigned to each theme) include:

1. Water Quality Assessment (11)   **5. Regulatory Review & Assessment (7)**
2. Watershed Management (10)   **6. Land Management & Planning (10)**
3. Habitat Management (10)   **7. Applied Research (3)**
4. Biodiversity & Species Protection (8)   **8. Other (3)**

B. Applications by Agency

The majority of the Natural Resources WG organizations identified between 9 and 13 operational applications in their respective agency. The Department of Environmental Quality and the Virginia Marine Resources Commission identified 3 applications each. The majority of each organization's individual applications fell into a few focused application themes. Chesapeake Bay Local Assistance Department's (CBLAD) applications (9) covered three themes: water quality management, watershed management, and land management. The Department of Environmental Quality's (DEQ) 3 applications were all assigned to the Regulatory Review and Assessment application theme category. The Department of Forestry (DOF), the Department of Conservation and Recreation (DCR) and the Virginia Institute of Marine Sciences (VIMS) had applications spread widely over a large number of themes. VIM's 12 applications fell into 5 thematic groups. DOF's 12 applications and DCR's 13 applications fell into six thematic groups each.

The following table (Table 1) summarizes the number of application themes by organization.

Application Themes	CBLAD	DCR	DEQ	DOF	DGIF	VMRC	VIMS	Total/Theme
1. Water Quality	5	5		1				**11**
2. Watershed Mgmt.	2	3		1			4	**10**
3. Habitat Mgmt.		1		2		2	5	**10**
4. Biodiversity Protection		1			6		1	**8**
5. Regulatory Review		1	3		1	1	1	**7**
6. Land Mgmt. & Planning	2	2		5	1			**10**
7. Applied Research				2			1	**3**
8. Other				1	2			**3**
Total # Applications/ Organization	**9**	**13**	**3**	**12**	**10**	**3**	**12**	

C. Applications by Mandate

After the initial iteration of the follow-up survey (see Appendix C), applications were evaluated according to mandate.[3] The Natural Resources WG members were asked to identify the applications that support a state or federal mandate.[4] Because the data is still being compiled, information associated with application mandates is only available on approximately 40 of 62 operational applications. As a result, there is only partial information available on application mandates and the associated data needs of these applications. Of the 40 follow-up surveys that were returned, 5 applications were identified as supporting federal mandates and 16 applications were identified as supporting state mandates.

Table 2 summarizes the application themes by state and federal mandates. The *Biodiversity Protection Application Theme* is associated with the greatest number of state and federally mandated applications (7). This application theme supports 5 state mandated applications and 2 federally mandated applications. The *Water Quality Application Theme* and the *Regulatory Review Theme* are associated with the second greatest number of total mandated applications (6) and support 4 State Mandates and 2 Federal Mandates.[5]

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[3] Mandated applications refer to a specific state or federal mandate that is *supported* by GIS analysis tools. These mandates do not stipulate that GIS must be used to support the mandate.

[4] "Other" mandates were not discussed in this document, because this term was poorly defined and was subjectively applied by the Workgroup.

[5] It should be noted that DEQ has not yet completed their follow-up surveys. All 3 of their GIS applications are associated with Regulatory Review and Assessment, and will likely be associated with a state or federal mandate.

Table 2: Application Themes by Mandate

Application Themes	State Mandate	Federal Mandate	Total (fed+state)
1. Water Quality	4	2	6
2. Watershed Mgmt.	2	0	2
3. Habitat Mgmt.	3	0	3
4. Biodiversity Protection	5	2	7
5. Regulatory Review	4	2	6
6. Land Mgmt. & Planning	2	0	2
7. Applied Research	0	0	0
8. Other	2	1	3
Total # Mandated Apps.	22	7	

In addition, Natural Resources WG organizations were asked in the follow-up survey to identify the applications that were associated with "other" mandates or missions.   Ten applications were identified as supporting "other" mandates or missions. However, these responses appear to be subjective and inconsistent and therefore no conclusions were drawn based on these responses.

V. The Natural Resources Spatial Data Summary

Along the Y-axis of the matrix, each of the spatial data layers used by the Natural Resources WG organizations in one or more applications are listed. Ninety-three spatial data layers were identified as being used in one or more of the 6 organizations' 62 operational applications. Each of these data layers has been developed and is being stored and/or maintained by one of the agencies or an external source (i.e., another state agency, local government, federal government agency).

A. Spatial Data by Theme

The 93 spatial data layers were assigned to one of eight spatial data themes. The spatial data themes (and the number of data layers associated with each theme) include:

1. Land Use (12)
2. Land Cover (12)
3. Hydrology (11)
4. Geology / Land Forms (11)
5. Socio-economic Community Infrastructure (19)
6. Monitoring / Site Assessment (17)
7. Natural Resource Conservation Areas (5)
8. Uncategorized (6)

The Land Use theme, for example, contains spatial data layers associated with land use (i.e. Confined Animals, Disturbed Urban Areas, Land Use, Unreported Timber Harvests, Aquaculture sites, etc.). The "Uncategorized" theme contains spatial data layers that are either associated with raw imagery sources (i.e. satellite imagery or DOQQ's), or that do not easily fit any of the other themes (i.e. submerged aquatic vegetation, or LULC [a hybrid classification scheme containing both land use and land cover]).[6]

B. Spatial Data by Agency

The 93 spatial data layers were also evaluated in relation to each Natural Resources WG organization that used the data layer(s) to support their business applications. An assessment of the data layers by organization is summarized in Table 3.

Table 3: Summary of Data Layers Used by Organization[7]

	# Different Data Layers	Total # of Data Layers	Applications per Agency	Average # of Different Layers per Application
1. CBLAD	31	85	9	3.4
2. DCR	64	206	13	4.9
3. DEQ	7	11	3	2.3
4. DGIF	61	233	12	5.1
5. DOF	50	256	10	5.0
6. VIMS	72	306	12	6.0
7. VMRC	34	51	3	11.3

VIMS, DGIF, and DCR use the highest number of "different" data layers in their applications (72, 61, and 64 respectively), followed by DOF (50), VMRC (34) and CBLAD (31).

VIMS and DOF used the highest total number of "different" data layers in their applications. This is not too surprising, as both VIMS and DOF have a relatively high number of operational GIS applications (12 and 10 respectively). Furthermore, VIMS, DOF, and DCR support applications from a relatively high number of application theme areas (see Table 1), which suggests that these organizations are involved with a high diversity of applications (requiring a high diversity of spatial data layers).[8] DGIF also uses a relatively large number of data layers with its internal applications. This is not only due to the fact that DGIF supports a high number of applications (12), but that DGIF's applications are also associated with a large number (and broader thematic base) of application themes and therefore require a greater variety of spatial data layers.

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[6] Raw imagery refers to imagery that has not been classified or processed to support a specific application.
[7] The total number of data layers refers to a total count of all of the data layers that were used by an organization to support all of its associated GIS applications (i.e. if soils was used to support 5 different applications, then each of the 5 uses would be counted towards the total number).
[8] DOF and DCR support applications from 6 application theme areas, VIMS supports applications from 5 application theme areas.

DEQ has the lowest average number of different layers per application. This is most likely due to the fact that DEQ's applications are associated with a single application theme (Regulatory Review and Assessment), and that the applications themselves (UST's, Waste tire piles, and Landfills) are more related to developing a spatial database inventory, than with spatial data modeling (which generally requires a more extensive and robust database).

A majority of the organizations (4) average between 4-6 different spatial data layers per application. These organizations all have some extensive spatial data modeling application requirements. The VMRC has the highest average number of different layers per application (11.3). This is primarily due to VMRC's *oyster beds* application, as the *oyster beds* application is supported by 29 different data layers. It should also be noted that VMRC has 3 operational applications. This, in combination with the high number of data layers, as compared to DEQ who also has 3 operational applications, accounts for the relatively high average number of different data layers per application.

VI. Improving Agency Applications by Improving Spatial Data

Following the initial survey of agency business applications and related geocoded/spatial data, the Natural Resources WG organizations determined that a more thorough evaluation of their applications was required. Therefore, a more detailed follow-up survey was provided digitally to each of the Natural Resources WG members. The follow-up survey was designed to ensure that the evaluation of data needs and priorities to support existing applications would be as fair and complete as possible.[9] Through this survey, the Natural Resources WG looked at the possibility of improving applications (products and services) by improving or acquiring better data.

It should be noted that approximately thirty percent (~20 of 62) of the distributed follow-up surveys were not returned. In addition, many of the surveys that were returned were incomplete. This was due to the fact that some of the managers were not familiar with the datasets used by their organizations. Efforts are currently underway to work with each organization to complete the surveys, and develop a more comprehensive understanding of the existing and future needs of the Natural Resources WG members. It is still possible, however, to draw some initial conclusions based on the current information available.

A. Identifying Existing Data Enhancement Needs

Many GIS applications use data layers with limited value (non-optimal scale and/or spatial extent), not because they are the most appropriate data layers to use, but because they are either the best data available, or the only data available. Inadequate or limited spatial data can be "improved" or "enhanced" in a couple of ways. Spatial data can

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[9] March 2001 Natural Resources Workgroup Meeting.

sometimes be more valuable to an application if the "spatial extent" or "area covered by the data" is expanded.   Spatial data can also be improved by acquiring data at a larger (finer) scale or resolution.[10] In either case the true "value" of enhancing existing layers or developing additional spatial data layers must be judged by the benefit that a change in data can provide to a specific application.

At the time that the work on The Natural Resources Application Matrix began, metadata was not available for many of the data resources identified in The Application Matrix.[11] Therefore, more specific information about the spatial data assets identified in The Application Matrix was collected through the detailed follow-up survey.

The survey asked Natural Resources WG members to identify the scale and spatial extent of each data layer that they were currently using to support each application. Selections were identified by work group members using a pull-down menu created in Visual Basic in order to facilitate the process (see Figure 1). Users were then asked to provide, where appropriate, the ideal scale and spatial extent of the identified spatial data layers.[12]

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[10] It should be noted that "Spatial Data Enhancement" may not simply refer to a spatial data layer that can be easily modified to adequately support an application (such as adding an attribute item and performing calculations to populate that item). The term spatial data enhancements in this section refer to actions that may result in the creation of a separate and new spatial data layer (i.e. developing a hydrography layer at a better scale), which can be an expensive, and time consuming process.

[11] The Virginia Metadata Clearinghouse is now online and has approximately 120 metadata entries. The Virginia Metadata Clearinghouse can be accessed through VGIN's home page http://www.vgin.state.va.us/.

[12]Some data layers were not initially developed to support a particular application. But if more appropriate data (i.e. data with a better resolution or scale) were not available to support the application, users may use the data because more appropriate or better data is not available. Users in the GIS community often refer to this situation when they state that they are using a database "by default".

Figure 1: Identifying Information Associated with Existing Data Layers

5. **Identify the data layers that are currently available (i.e. you currently use) to support your application, and choose the scales and coverage extents that most closely describe each layer:**
Note: Data layer names have already been added, according to 'the matrix submissions'. Feel free to add additional / missing data layers, however, do not include raw imagery products data products [i.e. Landsat, DOQQ's, etc]. All "value added" data products [i.e. land use, land cover, topography] that are derived from imagery products, and that are associated with this application should be included

#	Layer (Name)	Existing Scale (select one)	Ideal Scale (in a perfect world)	Coverage/Extent (dropdown menu)
1	Wetlands (24K)	Scale: 1:24,000	Scale: 1:1,200	Not statewide-Tidal v
2	Land Cover	Scale: 1:12,000	Scale: 1:1,200	Not statewide-Tidal v
3	Land Use	Scale: 1:12,000	Scale: 1:1,200	Not statewide-Tidal v
4	Watershed Boundaries	Scale: 1:24,000	Scale: 1:24,000	Not statewide-Tidal v
5	Detailed Hydro	Scale: 1:24,000	Scale: 1:24,000	Not statewide-Tidal v
6	Jurisdictional Boundaries (state, county,etc)	Scale: 1:24,000	Scale: 1:24,000	Not statewide-Tidal v
7	Riparian Buffers	Scale: 1:12,000	Scale: 1:1,200	Not statewide-Tidal v
8	Soils	Scale: 1:24,000	Scale: 1:12,000	Not statewide-Tidal v
9	Hydro	Scale: 1:24,000	Scale: 1:12,000	Not statewide-Tidal v
10	Shoreline Feature Identification	Scale: 1:12,000	Scale: 1:1,200	Not statewide-Tidal v
11	Boat Ramps (DGIF-owned)	Scale: GPS ▾	Scale:	Not statewide-Tidal v
12	Topography / contours	00	Scale: 1:12,000	Not statewide-Tidal v
13	Disturbed Urban Areas	GPS	Scale: 1:1,200	Not statewide-Tidal v
14	Replant areas	1:200	Scale: 1:1,200	Not statewide-Tidal v
15		1:400	Scale:	
16		1:1,200	Scale:	
17		1:4,800	Scale:	
18		1:12,000	Scale:	
19		1:24,000	Scale:	
20		1:100,000	Scale:	
21		< 1:100,000	Scale:	

B. Identifying New Data Development Needs

In the follow-up survey, Natural Resources WG members were also asked to identify any new data layers that, although not currently available, could significantly improve the benefits of a specific application. In this section of the follow-up survey (see Figure 2), Natural Resources WG members were asked to identify the new data layer, and the usable scales, ideal scales, and the coverage extents associated with each layer.

Figure 2: Identifying Critical Data Layers (Unavailable)

6. **Identify any data layers that are <u>not currently available</u> to support your application, but that could support this application if they were available.**
Note: do not include raw imagery products data products [i.e. Landsat, DOQ's, etc]. Do include "value added" data products [i.e. land use, land cover, topography] that may be derived from raw imagery.

#	Layer	Usable Scale (not ideal, but it would work)	Ideal Scale (in a perfect world)	Coverage/Extent (dropdown menu)
1	*Shoreline Position-current (24K)*	Scale: 1:24,000	Scale: 1:12,000	Statewide-Contiguous
2	*Bathymetry(Shallow Water)*	Scale: ▾	Scale: 1:12,000	Statewide-Contiguous
3	*Disturbed Areas*		Scale: 1:1,200	
4	*Riparian Buffers*	GPS	Scale: 1:1,200	Statewide-Contiguous
5	*Replant Areas*	1:200	Scale: 1:1,200	
6		1:400	Scale:	
7		1:1,200	Scale:	
8		1:4,800	Scale:	
9		1:12,000	Scale:	
10		1:24,000	Scale:	
		1:100,000		
		< 1:100,000		

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The Natural Resources WG continues to compile detailed information associated with each agency's operational applications and the data required to support each information product or service [see Appendix C].

VII. Prioritizing Virginia's Natural Resources Spatial Data Needs

One of the principal goals of the Natural Resources WG is to identify, across the "GIS application landscape" of the natural resources agencies, priorities for data development. With 62 operational applications supported by 93 spatial data layers, setting priorities is critical. Even though the "landscape" is incomplete and continues to evolve as more surveys are completed, it is possible to prepare an initial or preliminary assessment of natural resources WG's spatial data priorities. The following assessment will summarize the priorities for both enhancing existing spatial data layers (i.e. improving the scale of a data layer) and the outright initial development of new spatial data layers (i.e. statewide digital floodplain mapping).

Many of the agencies' business applications result from state mandates, federal mandates, or other reporting requirements. Many of the identified spatial data layers are critical to applications that support both federal and state mandates. One method for measuring the "demand" for a spatial data layer is to identify the number of mandated applications (state, federal, or state and federal combined) that each data layer supports.

Table 4 provides an example of how the "demand" for the Wetlands data layer can potentially be measured. The Wetlands data layer is used to support federally mandated applications and state mandated applications by several Natural Resources WG organizations.[13] In order to measure the "demand" for the Wetlands spatial data layer we can identify the total number of operational applications that require the Wetlands spatial data layer. Of this total we can also look in more detail at the number of applications that are state mandated, federally mandated or both. Wetlands ranks 2nd among all the data layers critical to both state mandated applications (the wetlands data layer supports 12 state mandated applications) and federally mandated applications (wetlands supports 4 federally mandated applications). In terms of *Total Applications*, the Wetlands layer ranks 5th relative to the other data layers (and supports 34 applications).

Table 4: Wetlands Related Applications

	Wetlands (NWI)		
	State Mandated Applications	Federally Mandated Applications	Total Applications
Rank	2	4	5
Number	12	4	34

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[13] The total number of applications represents not only Federal, State, and Other mandates, but includes applications that were not associated with any formal mandates. Typically, these applications supported the mission of the respective agency.

VIII. Virginia's Natural Resources Spatial Data Priorities

A. Data Priorities Based On State Mandates

Table 5 identifies the "demand" for individual spatial data layers based on the number of state mandated applications that each data layer supports. Hydrography is ranked first. Of the 41 returned follow-up surveys hydrography is associated with 25 state mandated applications. Wetlands (NWI) is ranked second, and is associated with 12 state mandated applications. Watershed boundaries is ranked third and is associated with 10 state mandated applications.

Table 5:
Evaluating Data Priorities: State Mandated Applications

Rank	Layer	# State Mandated Applications
1	Hydrography[14]	25
2	Wetlands	12
T-3	Watershed boundaries	9
T-3	Land use	9
T-3	Land cover	9
T-3	Elevation (topo/contours)	9
T-7	Jurisdictional Boundaries	8
T-7	Land Ownership	8
T-7	Boat ramps	8
T-7	Riparian Buffers	8
T-7	Endangered/threatened species waters	8
T-7	Wildlife Management Areas	8
T-13	Endangered/threatened species locations	7
T-13	Parcel Boundaries	7
T-13	Colonial Waterbird	7
T-13	Soils	7
T-13	Bay Preservation Act	7

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[14] Includes both 1:100,000 and 1:24,000.

B. Data Priorities Based On Federally Mandated Applications

Table 6 documents the "demand" for individual spatial data layers based on the number of federally mandated applications that each data layer supports. Hydrography supports more federal mandates than any other data layer used by the Natural Resources WG organizations. However, it should be noted only 7 federally mandated applications were identified by Natural Resources WG members. Using federal mandates alone may be an inappropriate method to evaluate data needs or "demand" because it does not recognize the application needs of the Commonwealth. Even so, the rankings are fairly consistent with the state mandated application ranking (refer to Table 5 above). Some of the differences are attributed to particular agencies (for example, the Department of Game and Inland Fisheries) that support applications that are both state and federally mandated (i.e. endangered and threatened species).

Table 6:
Evaluating Data Priorities- Federally Mandated Applications

Rank	Layer	# Federal Mandated Applications
1	Hydrography[15]	6
T-2	Land Use	5
T-2	Land Cover	5
T-4	Disturbed Urban Areas	4
T-4	Wetlands	4
T-4	Impaired Waters	4
T-4	Anadromous Fish Waters	4
T-4	Endangered/threatened species waters	4
T-4	Watershed boundaries	4
T-4	Soils	4
T-4	Elevation (Topography/contours)	4
T-4	Wildlife Management Areas	4
T-4	Colonial water bird nesting sites	4
T-4	Endangered/threatened species locations	4

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[15] Includes both 1:100,000 and 1:24,000.

C. Data Priorities Based On All Mandated (State & Federal) Applications

A better measure of real "demand" for data might include the total number of state and federally mandated applications supported by an individual spatial data layer (Table 7). Among all data layers the data layers with the most total mandates (state and federal) include: Hydrography (31), Wetlands (16), Land use (14), and Land cover (14), Watershed Boundaries (13), and Elevation (13).

Table 7: Data Layers Ranked by Use in State and Federally Mandated Applications

Rank	Layer	#State + Fed Mandated Applications
1	Hydrography	31
2	Wetlands	16
T-3	Land Use	14
T-3	Land Cover	14
T-5	Watershed Boundaries	13
T-5	Elevation (Topography/contours)	13
T-7	Endangered Species Waters	12
T-7	Wildlife Management Areas	12
T-9	Endangered/threatened species Locations	11
T-9	Colonial Waterbird	11

D. Data Priorities Based On All Applications

A final assessment of the "demand" for data is based on the "total" number of all natural resources applications that require a specific spatial data layer (Table 8). The total number of applications includes state mandated applications, federally mandated applications, and all other applications.[16]

Table 8: Summary of Data Priorities- All Applications[17]

Priority (Rank)	Spatial Data Layer	Total # of Applications
1	*Hydrography* [18]	79
2	Watershed boundaries[19]	39
T-3	Land Use	37
T-3	Land Cover	37
5	Wetlands	34
6	*Elevation (Topography/contours)*	32
7	*Jurisdictional Boundaries*	31
T-8	Riparian Forest Buffers	26
T-8	Soils	26
T-10	Census Data	24
T-10	Land Ownership	24
12	*Parcel Boundaries*	23
T-13	Flood Plain Boundaries	20
T-13	Disturbed Urban Areas	20

Hydrography, again, receives the highest ranking. This data layer is associated with 79 applications.[20] The Watershed Boundaries data layer is rated a distant 2nd, and is critical

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[16] Unclassified applications may not directly be associated with a particular state or federal mandate. However, these applications are critical to support the missions of the Natural Resources Workgroup agencies.

[17] FGDC framework data layers are highlighted in *blue italics*.

[18] Includes 1:24,000 and 1:100,000 hydrography layers.

[19] Includes 8-digit, 11-digit, 14-digit boundaries.

[20] Note that hydrography includes both general hydrography (1:100,000) and detailed hydrography (1:24,000). Both of these data sets may be associated with a single application. Therefore, the number of applications that is supported by hydrography (81) actually exceeds the total number of applications (62) identified by the Workgroup (see Appendix D for a list of applications).

to 39 natural resources applications. Land Use and Land Cover are ranked 3rd (tie) serving 37 applications each.

IX. Natural Resources Spatial Data Summary and Status in Virginia

This section provides a summary and current status of the priority data layers. The data layers are listed according to their rank (by "Total Application Demand"). In addition, this section includes the recommendations of the Natural Resources WG members to support the further development or enhancement of each data layer.

Rank	Layer	Rank	Layer
1	Hydrography	T-8	Riparian Forest Buffers
2	Watershed Boundaries	T-8	Soils
T-3	Land Use	T-10	Census Data
T-3	Land Cover	T-10	Land Ownership
5	Wetlands	12	Parcel Boundaries
6	Elevation	T-13	Flood Plain Boundaries
7	Jurisdictional Boundaries	T-13	Disturbed Urban Areas

A. Hydrography

Based on the collective needs of the Natural Resources WG organizations, hydrography is associated with the highest number of state mandated applications (25), and the highest number of federally mandated applications (6). Furthermore, hydrography was identified as the data layer that supports the greatest number of total applications (79). Hydrography therefore receives a unanimous priority ranking of "1".

	Hydrography		
	State Mandated Applications	Federally Mandated Applications	Total Applications
Rank	1	1	1
Number	25	6	79

Detailed hydrography (1:24,000) was associated with 37 applications, and general hydrography (1:100,000) was associated with 42 applications. Because the detailed hydrography file is not complete in Virginia, all statewide applications and mapping efforts that require hydrography use the general (1:100,000) hydrography file. For the purposes of establishing priorities, the Natural Resources WG members considered both the general-level (1:100,000) and detailed-level (1:24,000) hydrography data layers collectively (i.e. both scales of hydrography were associated with 79 applications).

The Status of Hydrography in Virginia

The 1:100,000 hydrography DLG's are complete for Virginia, and are available for download from the United States Geological Survey (USGS) as well as other sources (i.e. U.S. Census, VDOT, etc.). The 1:24,000 hydrography DLG's are not complete statewide (Figure 3).

Figure 3: 1:24,000 Hydrography DLG Status in Virginia

Digital Line Graph (DLG) Availability
7.5 Minute Hydrography Overlay
Data current as of 3/15/2002

☐ HYDROGRAPHY AVAILABLE FOR SALE
☐ HYDROGRAPHY IN PROGRESS
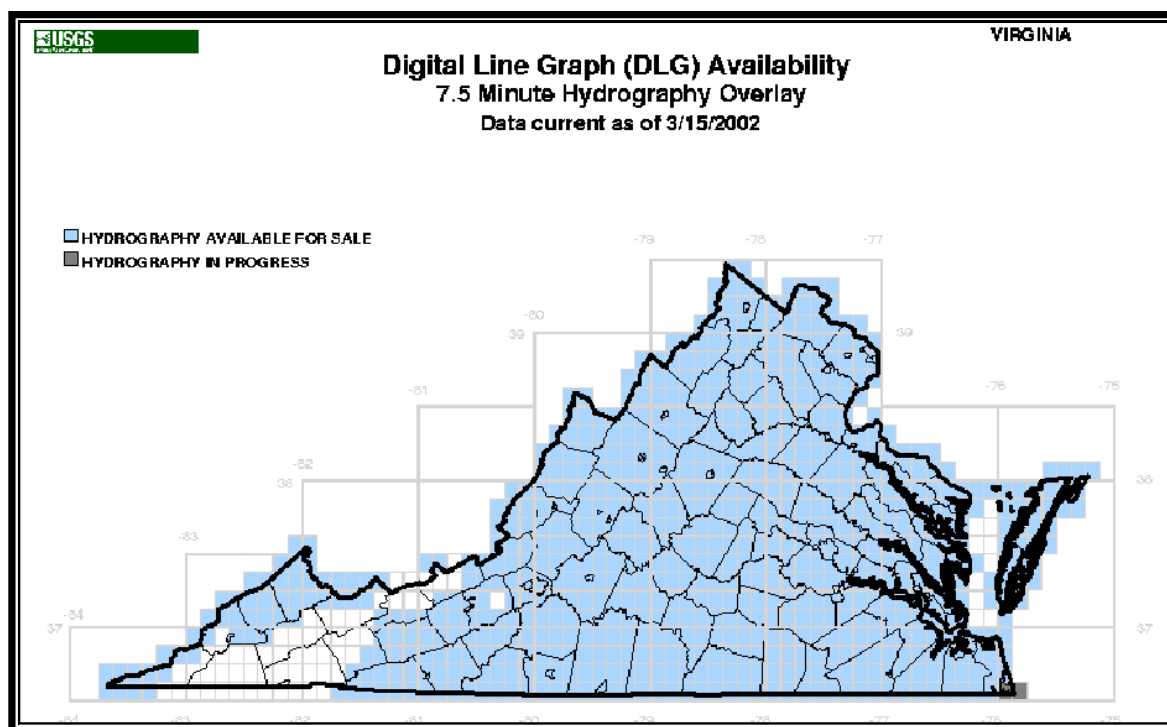
Efforts are currently underway to enhance Virginia's hydrology file. VGIN, in partnership with the North Carolina Center for Information and Analysis (NCGIA) and the United States Geological Survey (USGS), completed 164 of the 1:24,000 hydro DLG's in the Roanoke, Chowan, New River, and Albemarle Sound Coastal basins in Southern Virginia last year. These quadrangles have been quality controlled, and are now available for download from the USGS.

Currently, there are 59 1:24,000 DLG's that have not been completed in Virginia. These quadrangles are located in the southwestern region of the Commonwealth. The Virginia Department of Mines, Minerals, and Energy (DMME) contracted the digital development of line work for approximately 30 of the 59 remaining hydrology quadrangles. While the USGS has determined that these quadrangles do not conform to DLG standards, these data could support some GIS applications (see Figure 4, and Appendix E).[21]

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[21]The USGS provided the following list of limitations of the DMME data: a.) There was no revised data or man-made shorelines collected. Probably because they are on other plates; b.) Intermittent streams were collected as individual pieces of lines and dots, not as continuous lines; c.) Coding was the same whether the vector was a river or a shoreline (double line stream or water bodies); d.) There was no topology or collection of area identifications such as pond or stream river; e.) Many lakes were not closed because of missing manmade shorelines, dams or revised data.

Figure 4: 1:24,000 Hydro DLG Status in southwest Virginia[22]
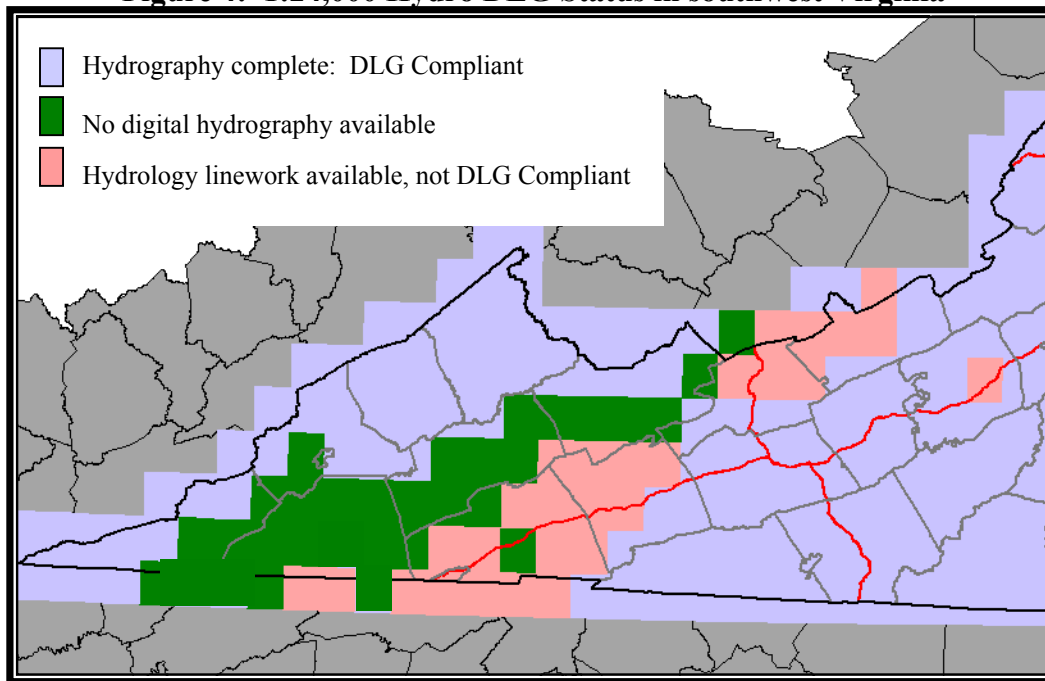
High-resolution hydrography (1:4800 or better) for the entire land base of the
Commonwealth is being extracted from 2002 color digital orthophotography as part
of the Virginia Base Mapping Program (VBMP). This is cost effective, as it is
estimated that 80% of the hydrographic features have already been collected as
breaklines to support the orthorecitification of the Virginia Base Mapping Program.[23]
The VBMP project will produce hydrography line work by March 2003. However,
further work will be required to provide complete topological connectivity and
detailed attribution.   VGIN is currently working to identifying partners to complete
the attribution/connectivity portion of the project.

Recommendations and Additional Prospects

The Natural Resources WG agreed that acquiring higher resolution hydrography is
the highest priority, given the collective application needs of the group. The group
also identified the National Hydrology Dataset (NHD) as an appropriate model to
support existing and future applications. The NHD incorporates the spatial
information associated with the USGS DLG's, with some of the linear referencing
and attribution associated with the EPA's River Reach File (RF3).

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[22] All 1:24,000 DLG hydro quadrangles are complete for the rest of the Commonwealth, and are currently
distributed by the USGS.

[23]Breaklines control surface behavior in terms of smoothness and continuity. Breaklines can describe and
enforce a change in the behavior of the surface. Breaklines can be categorized as either hard and soft. Hard
breaklines define interruptions in surface smoothness and are typically used to define streams, ridges,
shorelines, building footprints, dams, and other locations of abrupt surface change. Soft breaklines are used
to ensure that known "Z" (elevation) values along a linear feature (such as a roadway) are maintained in a
TIN.

The 1:100,000 NHD has been completed for Virginia. The USGS has identified the Chesapeake Bay Watershed as a high priority area, and is currently working to complete the NHD for this region at 1:24,000. In addition, the US Forest Service is in the process of developing 1:24,000 NHD in USFS lands. At this point, there are no efforts underway to complete the 1:24,000 NHD for the watersheds that flow into North Carolina (i.e. the Roanoke, Chowan, New River, and Albemarle Sound Coastal basins), or to develop the NHD for the western part of the Commonwealth of Virginia.[24]

Figure 5: The Status of the 1:24,000 NHD in Virginia
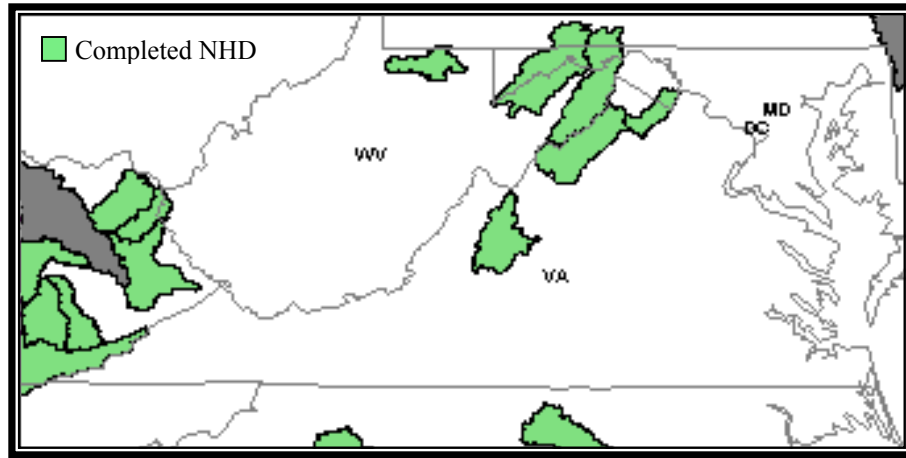
B. Watershed Boundaries

Overall, watersheds were identified as the second most important layer in supporting the collective needs of the Natural Resources WG, supporting 39 "total" applications. Watershed boundaries were also ranked high in terms of supporting state mandated applications (ranked 3rd) and federally mandated applications (ranked 4th). Watershed boundaries are necessary to support water quality assessments, watershed management and land use planning applications.

	Watershed Boundaries		
	State Mandated Applications	Federally Mandated Applications	Total Applications
Rank	3 (tie)	4 (tie)	2
Number	9	4	39

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[24] VGIN has been contacted by NCGIA to participate in a partnership to develop the NHD for the Roanoke, Chowan, New River, and Albemarle Sound Coastal basins in Southern Virginia. The estimated cost for completing the NHD for these watersheds is approximately $300,000 (three year project, with the USGS contributing 50% of the cost of the project, and the remaining costs to be divided between project partners that could potentially include Virginia and NCGIA).

The Current Status of Watersheds in Virginia

Currently, the Department of Conservation and Recreation has developed and is maintaining the 8-digit, 11-digit, and 14-digit hydrologic units across the Commonwealth. DCR is also currently developing the Virginia portion of the National Watershed Boundary Dataset (NWBD) at 1:24,000.

Recommendations

The Natural Resources WG concurred that DCR's data development efforts are sufficient to support most applications and that currently, there is no need to enhance this data resource.

C. Land Use and Land Cover

Although two separate data layers, land use and land cover support very similar levels of collective needs for the Natural Resources WG organizations. Both of these data layers support 37 applications overall, and receive an overall ranking of 3rd. Both land use and land cover support 9 mandated state applications, and both receive a state mandated application ranking of 3rd. Both of these data layers support 5 federally mandated applications, and receive a federally mandated application ranking of 2nd.

	Land Use			Land Cover		
	State Mandated Applications	Federally Mandated Applications	Total Applications	State Mandated Applications	Federally Mandated Applications	Total Applications
Rank	3 (tie)	2 (tie)	3 (tie)	3 (tie)	2 (tie)	3 (tie)
Number	9	5	37	9	5	37

While land use and land cover are often used synonymously, these two data layers represent two distinct approaches to classification of the surface of the earth. These two data layers may individually support separate applications, or they may both be required to support a single application. Land cover refers to a descriptive classification of features that are present on the surface of the earth (i.e. forests, lakes, grasslands, wetlands). Land use refers to cultural or anthropological activities that are associated within the landscape (i.e. suburban/single family residential, commercial, agricultural). These two data layers represent *value-added* data products that are derived from either multi-spectral or single band imagery (sometimes referred to as raw imagery). Land use and land cover may either be generated from satellite imagery or from digital imagery acquired from aircraft (digital orthophotography).

The Current Status of Land Use and Land Cover in Virginia

There are several sources of land cover options available (statewide) for Virginia. All of the sources outlined in this document were classified from Landsat TM or EMT+ imagery.[25] While all of these products were derived from a consistent imagery platform (Landsat), there are distinct differences associated with the classified products.

Some differences in the classified products are attributed to different classification techniques and methodologies. Furthermore, the classification schemes themselves were customized to best support each individual application. Finally, classification itself is an interpretive process that involves as much "art" as "science".

Landsat imagery is often used as an imagery source for land use and land cover mapping over large areas for several reasons. Probably the most advantageous benefit associated with Landsat imagery is cost. Landsat imagery is available at a relatively low cost / square mile.[26] Once purchased by a state of federal agency, the imagery can usually be shared, at no cost, among other public institutions.[27]

There are four land use / land coverage efforts currently underway in Virginia. These include:

- The Department of Forestry's Forest Resource Assessment Program is developing forestland use and forest type maps from classified Landsat 7 satellite imagery, captured in 2000. The program is using ground reference data from over 7,000 ground forest inventory plots, for image classification training and validation. The classification process also made use of ancillary data, including DOQQ aerial photographs, 1999 SPOT 10m panchromatic imagery, VDOT roads, state forest stand maps, VIMS marshes and shorelines, and DCR conserved lands coverage. The target for public release is June 30, 2002.

    Expected outputs will include tree cover, areas meeting forestland use definitions, forest patches, and forest types at the level of deciduous, mixed, evergreen and transitional (harvested and disturbed areas). The classified imagery will be used to develop estimates of forestland area, and distribution of forestland by broad forest

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[25]Landsat detects spectrally-filtered radiation at visible, near-infrared, short-wave, and thermal infrared frequency bands from the sun-lit Earth. Both Landsat TM and EMT+ maintain a resolution of 30 meters in the 6 visible, near and short-wave infrared bands; and 60 meters in the thermal infrared band. EMT+ includes a panchromatic band, with a resolution of 15 meters.

[26] Typically, higher spatial resolution is reflected in higher imagery cost per area (i.e. per sq. mile). Refer to http://www.vgin.state.va.us/documents/imagery_options/Imagery_Options.PDF for a cost comparison of different imagery products.

[27] However, it should be noted that most state agencies lack the internal capabilities (both staff and software related) to support the classification of satellite imagery).

types. The classification will also be used to assess forest fragmentation, and when combined with 2000 census data, the impact of development upon forests.

- The Multi Resolution Land Characteristics Consortium (MRLC) developed the National Land Cover Dataset (NLCD).   This land cover data set was first developed in 1990, and there are efforts currently underway to update the NLCD. The main objective of this project is to generate a generalized and nationally consistent land cover data layer for the entire conterminous United States. These data can be used as a layer in a geographic information system (GIS) for any number of purposes such assessing wildlife habitat, water quality and pesticide runoff, and land use change. The NLCD was generated from Landsat TM imagery.

- The Virginia GAP Analysis Project is a cooperative effort funded primarily by the National Biological Service and the Virginia Department of Game and Inland Fisheries to develop a statewide digital habitat map based on Landsat TM satellite imagery and other ancillary data sources. One of the objectives of the project is to identify areas with high vertebrate species richness.

- Land use is being developed for Virginia through a grant project between DCR and the USGS and the RESAC at the University of Maryland. The principal purpose for the development of this layer is its use in Phase 5 of the Chesapeake Bay Watershed Model, but DCR will use it in other program areas as well.

Recommendations

The Natural Resources WG members concurred that all of the active state and federal agencies currently working on the generation of land use or land cover data in Virginia should present their mapping initiatives at a State User Group Meeting. This meeting should serve to educate users about the available land use and land cover data options in Virginia, and should outline the advantages, disadvantages, and appropriate applications associated with each of these data options.

D. Wetlands

Based on the collective needs of the Natural Resources WG organizations, wetlands supports 12 state mandated applications (and is ranked 2nd), and 4 federally mandated applications (and is ranked 4th). In terms of total applications, Wetlands is associated with 34 applications, and therefore receives an overall ranking of 5th.

Wetlands (NWI)		
State Mandated Applications	Federally Mandated Applications	Total Applications
Rank 2	4 (tie)	5
Number 12	4	34

Wetlands across the Commonwealth are developed and maintained by the U.S. Fish and Wildlife Service through the National Wetlands Inventory (NWI). The NWI in Virginia is based on a scale of 1:24,000.

The Current Status of Wetlands in Virginia

While the NWI has been completed across the Commonwealth, not all of the quadrangles are available in a digital format. There are 13 quadrangles located in Northern Virginia that have not been digitized. The U.S. Fish and Wildlife Service is unable to provide a target date for the completion of these quadrangles (see Figure 6 below, and Appendix F).

Figure 6: Status of Digital NWI Quads in Virginia
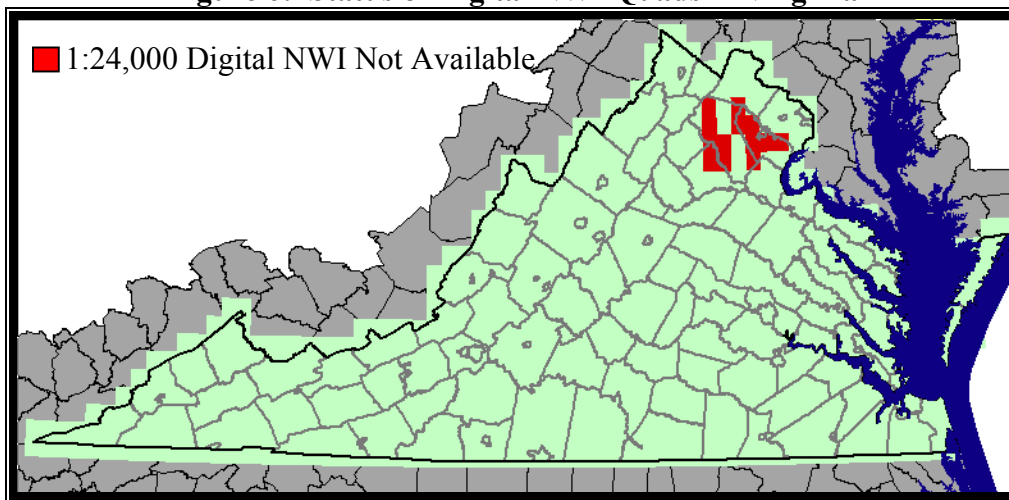
Furthermore, it should be noted that the majority of NWI quadrangles available for the Commonwealth is dated (Table 9). 665 of Virginia's NWI quadrangles (approximately 90% of all quadrangles) have not been undated since 1990.

Table 9:
Currency of NWI Quadrangles
in Virginia[28]

Photo Date	# NWI Quads
1979 or earlier	12
1980-1985	494
1986-1990	159
1991-1995	46
1996 –2000	24
2000 or later	0

Recommendations

The Natural Resources WG members agreed that the existing level of detail in the NWI is sufficient to support most applications and that currently, there is no need to enhance the scale of this data resource. Members of the group expressed interest in updating the NWI data. The cost of updating the NWI quads is estimated by the U.S. Fish and Wildlife Service to be approximately $1,000 – $1,500 / quadrangle. However, no formal recommendations have been made at this time.

E.   Elevation (Topography/contours)

Based on the collective needs of the Natural Resources WG organizations, elevation is associated with 9 state mandated applications, and 4 federally mandated applications, and received a ranking of 3rd and 4th respectively. Overall, elevation is associated with 32 applications and receives an overall ranking of 6th.

	Elevation (Topography/contours)		
	State Mandated Applications	**Federally Mandated Applications**	**Total Applications**
Rank	3 (tie)	4 (tie)	6
Number	9	4	32

Elevation data adds a vertical dimension (z value) to the traditional x and y coordinates associated with spatial data features. Elevation can be expressed as isolines (contours), through a Triangular Irregular Network (TIN) or a Digital Elevation Model (DEM).

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[28] This table only includes the NWI quadrangles that are located entirely within Virginia.
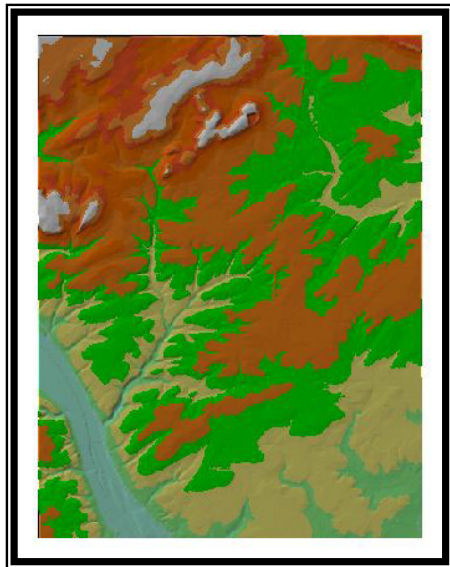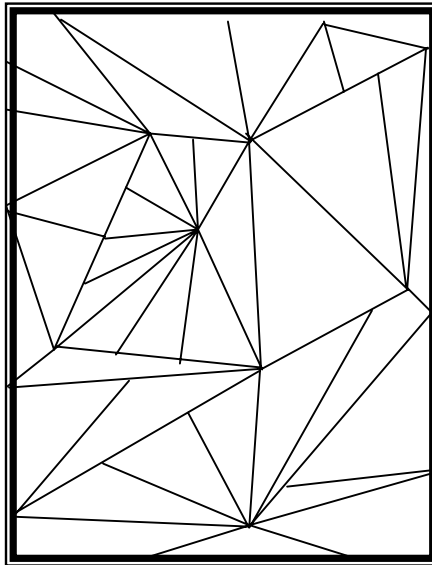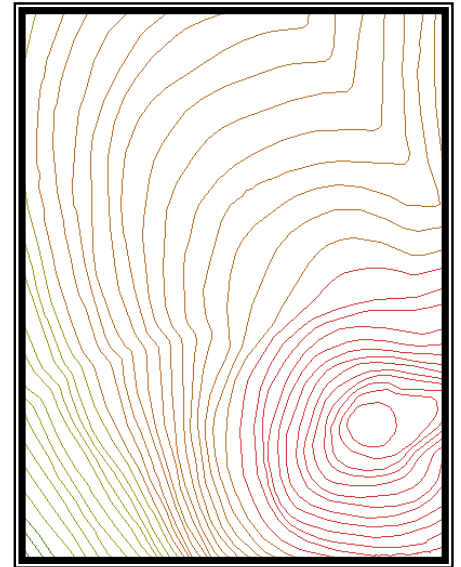
| Classified DEM | TIN | Contours |

DEM's are raster representations of elevations. TIN's are vector-based models used to represent elevation. Both of these approaches can support many GIS modeling applications. TIN's are often used to derive slope and aspect models of the landscape, and may serve as important parameters in assessing water runoff rates, soil loss, and volumetrics. Contours, on the other hand, are vector-based elevation models that are most often used to support two-dimensional cartographic products.

Elevation data is an important component of watershed planning and management, and supports numerous water quality assessment applications in Virginia. Elevation data is also used to predict viable habitats and to support biodiversity planning and management, and is an important element in forest resource management. Slope and aspect are easily generated from digital elevation data to support an array of planning, management, and design applications.

The Status of DEM Data in Virginia

30 meter DEM's are available across the Commonwealth through the USGS. In addition, 10 meter DEM's are available in selected areas of the Commonwealth (**see Figure 7**). However, DEM's are not available at a resolution that can support a majority of the applications identified by the Natural Resources WG members.

Figure 7: Status of 10 meter DEM's in Virginia

Digital Elevation Model (DEM) Availability
7.5-Minute Series
Data current as of 3/15/2002
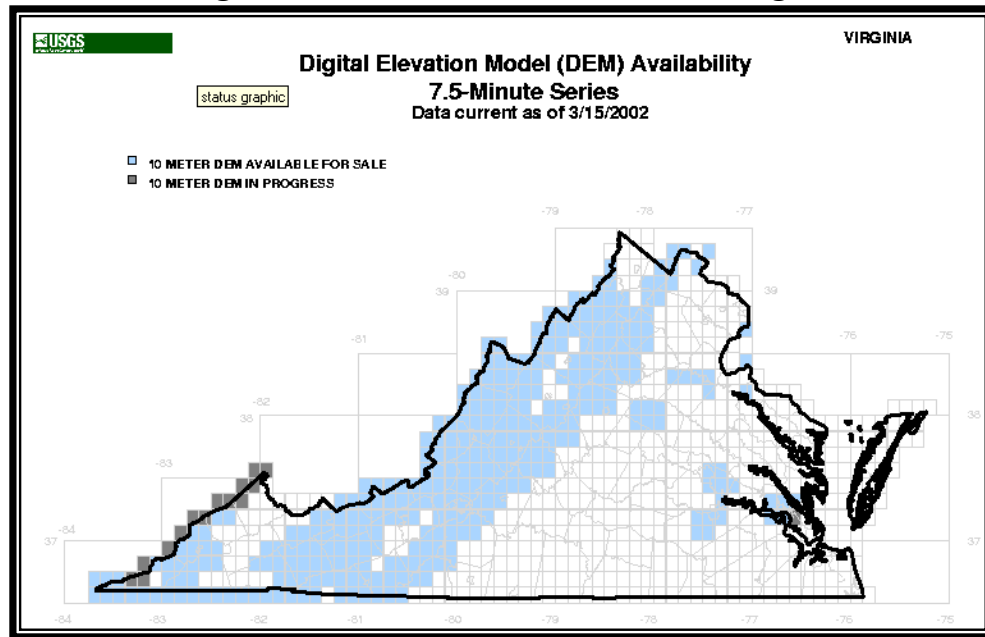
The National Elevation Dataset (NED) is the most commonly used statewide DEM used by Virginia's state agencies. The NED was developed by the USGS to provide a seamless elevation model at the highest resolution available. Even still, the NED can only provide data that is archived by the USGS, and is therefore limited to their 10 meter or 30 meter products. This data product is most often used to support GIS applications, not because it is the most appropriate source, but because there is no better source currently available.

The Status of Contour Data in Virginia

Currently there is no statewide digital contour data available for Virginia. The USGS 1:100,000 series contours are available for most of the Chesapeake Bay Watershed. Unfortunately, this data is at an inappropriate scale for most applications identified by the Natural Resources WG. The USGS is in the process of generating a 1:24,000 contours layer. This effort has been completed along the Blue Ridge Parkway, and in other selected western areas. The Commonwealth is approximately 25% completed at this scale (Figure 8).

Figure 8: Status of 1:24,000 Contours in Virginia
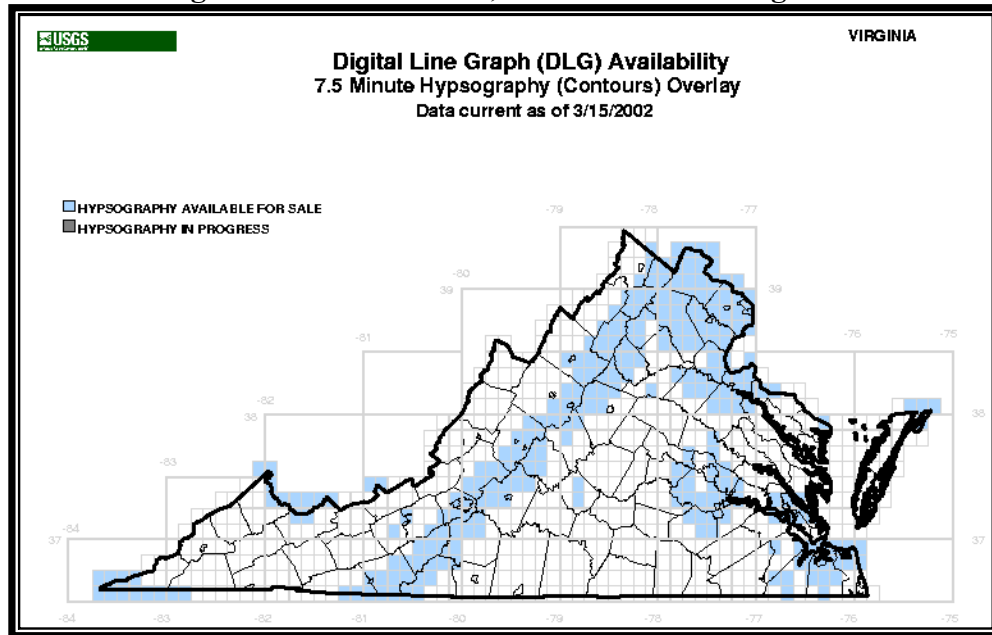
Recommendations and Other Potential Data Sources

The Natural Resources WG agreed that currently there was no additional action that should be taken to support the development of a statewide enhanced elevation database. This was due, in part, to the fact that the group recognizes that the generation of elevation data is expensive.[29]

However, one option that is currently under consideration is to support the development of a statewide higher resolution DEM based on the elevation model that is being developed to support the production of the Virginia Base Mapping Program. With major enhancements, the existing digital elevation model would support 2' contours (1:1,200 areas), 4' contours (1:2,400 areas) and 10' contours (1:4,800 areas).

F. Jurisdictional Boundaries

Based on the collective needs of the Natural Resources WG organizations, the jurisdictional (i.e. political) boundaries layer is associated with 8 state mandated applications and 2 federally mandated applications. Based on these two mandate classes, this layer ranks 7th and higher than 15th respectively. In terms of total applications, this layer is associated with 31 applications, and receives an overall ranking of 7th.

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[29] Innovative technologies (including LIDAR and IFSAR) need to be fully examined to determine the feasibility of generating a cost effective DEM statewide.

Jurisdictional Boundaries		
State Mandated Applications	Federally Mandated Applications	Total Applications
Rank 7 (tie)	>15	7
Number 8	2	31

Jurisdictional boundaries include political boundaries for 134 cities and counties across the Commonwealth.

The Status of Jurisdictional Boundaries in Virginia

Jurisdictional boundaries are available from several sources including: the USGS DLG's which are currently available statewide at 1:100,000. Jurisdictional boundaries are also available through the U.S. Census Bureau (1:100,000). DCR has digitized the jurisdictional boundaries from 1:24,000 hard copy 7.5 min topographic maps. Currently, DCR is in the process of updating and spatially enhancing this product by digitizing off the 1:24,000 DRG's.

Recommendations

The Natural Resources WG concurred that DCR's new database (1:24,000) is sufficient to support most applications and that currently, there is no need to enhance this data resource.

G. Riparian Forest Buffers

Based on the collective needs of the Natural Resources WG organizations, the Riparian Forest Buffers layer is associated with 8 state mandated applications (and is ranked 7th) and two federally mandated applications (and is ranked higher than 15th). Overall, this layer is associated with 26 applications, and receives an overall ranking of 8th.

Riparian Forest Buffers		
State Mandated Applications	Federally Mandated Applications	Total Applications
Rank 7 (tie)	>15	8 (tie)
Number 8	2	26

The Riparian Forest Buffers layer could actually be considered to be a subset of a land cover dataset.

The Status of Riparian Forest Buffers in Virginia

Penn State University Land Analysis Laboratory has produced a layer of forested riparian buffers for New York, Pennsylvania, Maryland, West Virginia and Virginia based on

EPA's EMAP Land Cover/Land Use and USGS hydrography (varying scales). The project aimed to inventory riparian forest conditions within 100 and 300 feet of streams. This riparian buffer layer is more useful for watershed or regional analyses because the data layers used in its development are of a coarse resolution and smaller scale.

The Virginia Department of Forestry has developed a Riparian Forest Buffer layer to support their Tax Credits Application that contains buffers mapped with GPS. However, each polygon in this layer represents a protected riparian buffer area on a participating individual's property, rather than a complete inventory of riparian areas adjacent to streams or rivers. The buffers are not contiguous, and the layer is probably not comprehensive enough to be used for most other applications.

Other agencies (i.e. VIMS) have developed a Riparian Forest Buffer layer to support their individual application needs, but are limited in geographic extent. Several water quality related applications, habitat management applications, regulatory applications, and planning applications are also supported by the riparian forest buffer layer.

The Riparian Forest data layer is not available at 1:24,000 statewide in Virginia.

Recommendations

The Natural Resources WG discussed options for developing a statewide riparian forest layer. The Department of Forestry may develop a statewide riparian forest buffer layer if there are sufficient application demands for this data product. This layer would be derived from DOF's Forest Resource Assessment Program. No conclusion was reached by the Natural Resources WG.

H. Soils

Based on the collective needs of the Natural Resources WG organizations, the soils layer is associated with 7 state mandated applications and 4 federally mandated applications. Based on these two mandate classes, this layer ranks 7th (in terms of supporting state mandates) and 4th (in terms of supporting federal mandates). In terms of total applications, this layer is associated with 26 applications, and receives an overall ranking of 8th.

Soils		
State Mandated Applications	Federally Mandated Applications	Total Applications
13 (tie)	4 (tie)	8 (tie)
7	4	26

(Rows labeled "Rank" and "Number" to the left of the table.)

Soils data can support a variety of applications, including: watershed planning and management, woodland suitability, and the identification and management of wildlife habitats.

The Status of Soils in Virginia

There are three soils databases in Virginia. Soil maps for the State Soil Geographic (STATSGO) database are made by generalizing detailed soil survey data. The mapping scale for STATSGO maps is 1:250,000. While this dataset is complete statewide, the level of mapping is only appropriate for very broad planning and management uses extending across large regions, state, and multi-state areas. STATSGO was therefore not identified as an appropriate database to support any applications associated with Natural Resources WG Members.

A more detailed vector soil product called the Soil Survey Geographic (SSURGO) database is currently underdevelopment by the USDA - Natural Resources Conservation Service (NRCS). The soil delineations have been manually recompiled from the county soil surveys to a base map of 1:24,000 or 1:12,000. The mylar stable USGS quadrangle was historically the base map for the SSURGO product. However, the Digital Orthophoto Quarter Quads (DOQQ's) have now become the base map for the recompilation process. The SSURGO database, however, remains incomplete for many counties in Virginia (See Figure 9 below, and Appendix G).

Figure 9: SSURGO Data Status in Virginia
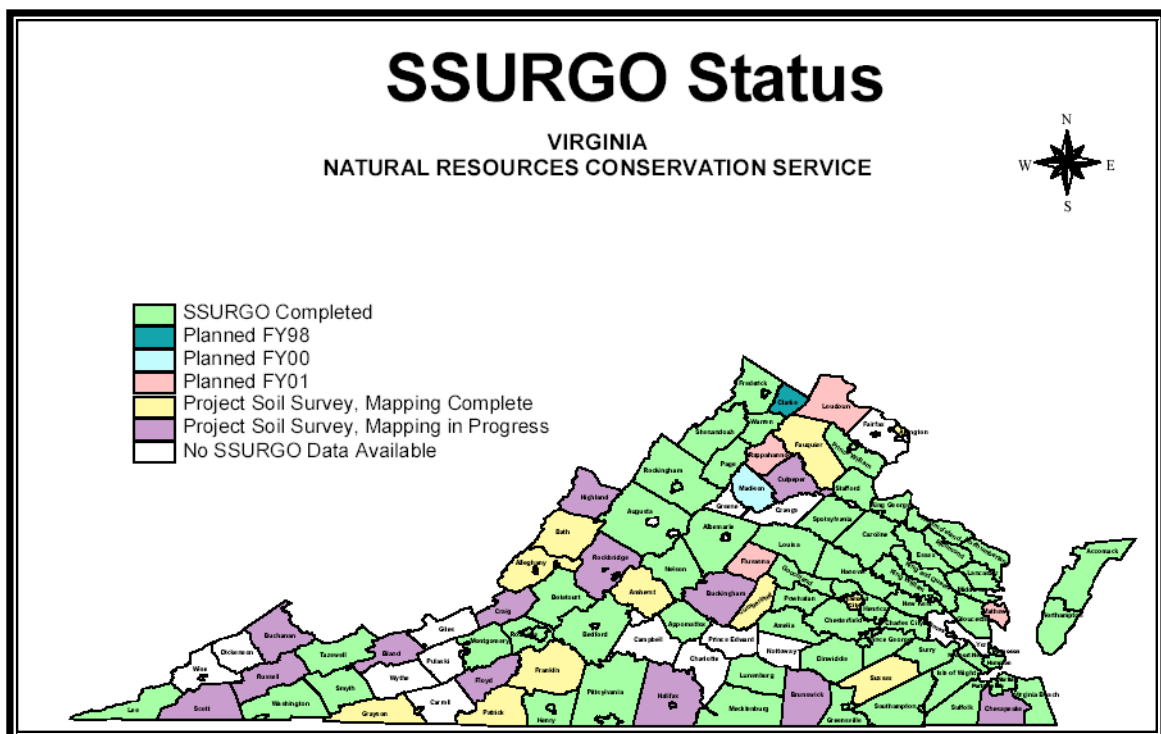
Examples of information that can be queried from the SSURGO database include: water capacity, soil reaction, salinity, flooding, water table, and bedrock; building site

development and engineering uses; cropland, etc. Soils data are used to support 3 state mandated business applications and 4 federally mandated applications. The SSURGO soils database could be used in more applications. Currently, a limiting factor with the application of the database is that the SSURGO database does not extend across the Commonwealth or other project application boundaries (i.e. watersheds).

A third soils database is the VirGIS raster soil dataset from DCR. The cell size associated with these raster datasets is either 1 hectare or 1/9 hectare. They were captured during the period 1986 to 1996. Raster matrices covering 76 counties and cities in Virginia are available in this form, including 24 not available in the SSURGO format. There are limited attributes available for the raster datasets. However, the soil name and symbol are two of the attributes captured, allowing the cells to be related to other attributes of the soil available in the printed soil surveys.

Recommendations

The Natural Resources WG members agreed that, when available, the USDA's SSURGO soils will be sufficient to support most applications. While the SSURGO database is being developed by the federal government, state funding could facilitate the generation and maintenance of this data set. However, the group recommended that due to limited resources and higher priorities, no action is necessary to support the development of soils at this time.

I. Census Data

Based on the collective needs of the Natural Resources WG organizations, census data is associated with 6 state mandated applications and 1 federally mandated application. Based on both of these two classifications, this layer ranks higher than 15[th for] both. In terms of total applications, this layer is associated with 24 applications, and receives an overall ranking of 10th.

Census Data		
State Mandated Applications	Federally Mandated Applications	Total Applications
>15	>15	10 (tie)
6	1	24

(Rank row: >15, >15, 10 (tie); Number row: 6, 1, 24)

The Status of Census Data in Virginia

Census data is periodically released by the U.S. Census Bureau as TIGER line files.[30] TIGER files contain features that include: roads, rivers, lakes, and political boundaries.

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[30] **T**opologically **I**ntegrated **G**eographic **E**ncoding and **R**eferencing

TIGER files were compiled at a scale of 1:100,000 and include various levels of census boundary geographies (Figure 10).

Some features (i.e. hydrography, roads) are available at more accurate scales, and are updated more frequently from other private sector resellers. These features are most often acquired by state agencies from the most accurate or appropriate source. The census data product used most often by state agencies are the demographic summary data files. This data is provided at several levels of geography using: block, block group, tract, and county boundaries. In order to protect confidentiality, not all census data are available to the public at all levels of geography.

Census data (statewide cartographic boundary files) can be downloaded directly from the U.S. Census Bureau (http://www.census.gov/geo/www/cob/) in several formats. However, it should be noted that the census attribute files require some formatting. Selected census data features and selected attributes are also available for free (by county) from the geography network (http://www.geographynetwork.com). A comprehensive list of census attributes is available on the census web site (http://www.census.gov/population/www/cen2000/sf3tms.pdf).[31]

Figure 10: Census Small Area Geography

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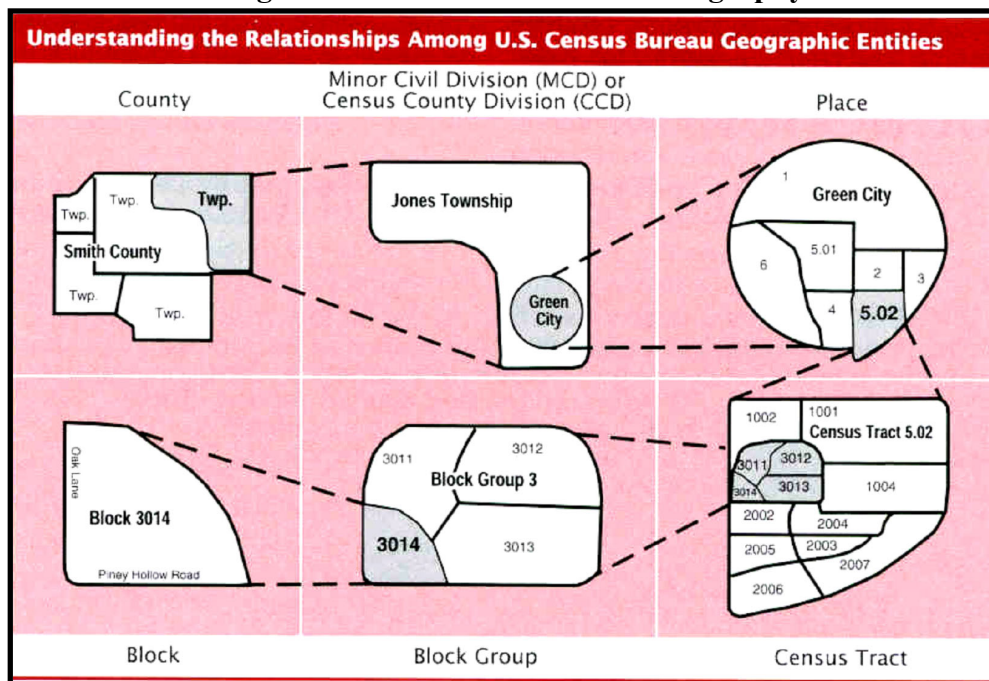
[31] Note that these census attributes are associated with Summary File 3 (SF3). Summary File 3 will be released for Virginia in August/September 2002.

Recommendations

The Natural Resources WG agreed that the existing level of detail is sufficient to support most applications and that currently, there is no need to enhance this data resource.

J.   Land Ownership and Parcel Boundaries

Based on the collective needs of the Natural Resources WG organizations, land ownership is associated with 8 state mandated applications and 3 federally mandated applications, and receives a ranking of 7th and higher than 15th, respectively. Overall, this data layer was associated with 24 applications, and was ranked 10th relative to the other data layers.

Land Ownership		
State Mandated Applications	Federally Mandated Applications	Total Applications
Rank	7	>15	10 (tie)
Number	8	3	24

The parcel boundaries layer is closely related with land ownership. It is therefore not surprising that there is a similar "demand" for both the parcel boundaries layer and land ownership by the Natural Resources WG organizations. Parcel boundaries is associated with 7 state mandated applications and 3 federally mandated applications. Based on these two mandate classes, this layer ranks 13th (in terms of supporting state mandates) and higher than 15th (in terms of supporting federal mandates). In terms of total applications, this layer is associated with 23 applications, and receives an overall ranking of 12th.

Parcel Boundaries		
State Mandated Applications	Federally Mandated Applications	Total Applications
Rank	13 (tie)	>15	12
Number	7	3	23

While parcel boundaries data refers to the spatial configuration of the property (i.e. the extents of the property lines), land ownership associates the legal ownership of the property (i.e. federal, state, local, or private individual). Collectively, land ownership and the parcel boundaries layers are often referred to as cadastral information.[32]

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[32]Cadastral information includes parcel or legal boundaries, descriptions of the property, and information associated with the legal rights and ownership of the property.

Currently, there is no statewide depository of cadastral information in the Commonwealth. However, cadastral data is being developed and is available in Virginia on a county-by-county basis. While there are several approaches that localities can take to support the development of cadastral information, the majority of localities that have comprehensive digital cadastral data have primarily developed this data resource from high resolution (i.e. 1:4,800 or better) digital orthophotography. Localities may hire a company to fly and create the digital imagery, or they may enter into a contractual licensing agreement with a speculative contractor who has already flown their area to provide them with an appropriate digital ortho base map. The parcel information is then delineated from these base maps (again, typically through outsourcing to consultants).

Status of Cadastral Information in Virginia

While the acquisition of digital orthoimagery (which is used not only to support cadastral mapping, but the development of other local databases as well) has historically been a piecemeal process in Virginia (see Figure 11 and Figure 12), the Virginia High Resolution Base Mapping Program (VBMP) will provide a free and consistent base map to support the development of local databases for localities statewide.

Figure 11: Base Map Data Source in Virginia
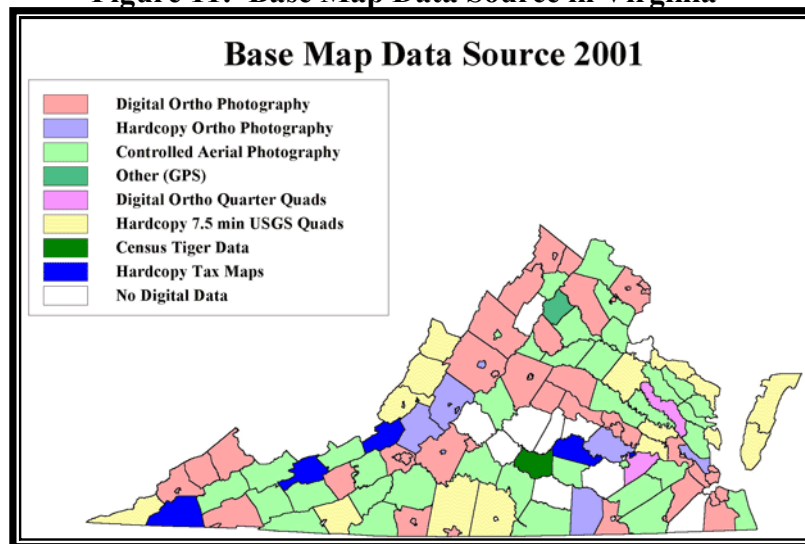
Figure 12: Scale of Base Map Data in Virginia
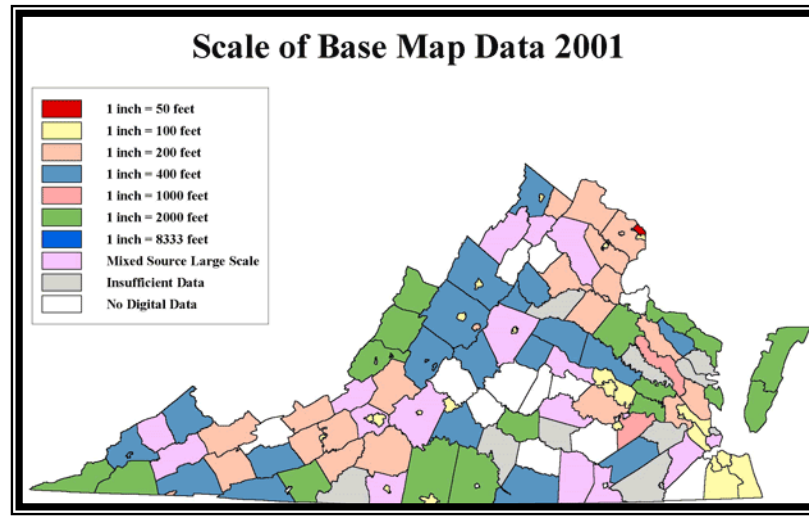
The VBMP will provide all localities in the Commonwealth with an accurate base map. These digital orthos will be available at one of three scales (contingent on population and housing density [refer to Figure 13]):

- 1:4,800 / 400 scale (2 foot resolution)
- 1:2,400 / 200 scale (1 foot resolution)
- 1:1,200 / 100 scale (6" resolution)

Figure 13: The Virginia Base Mapping Program
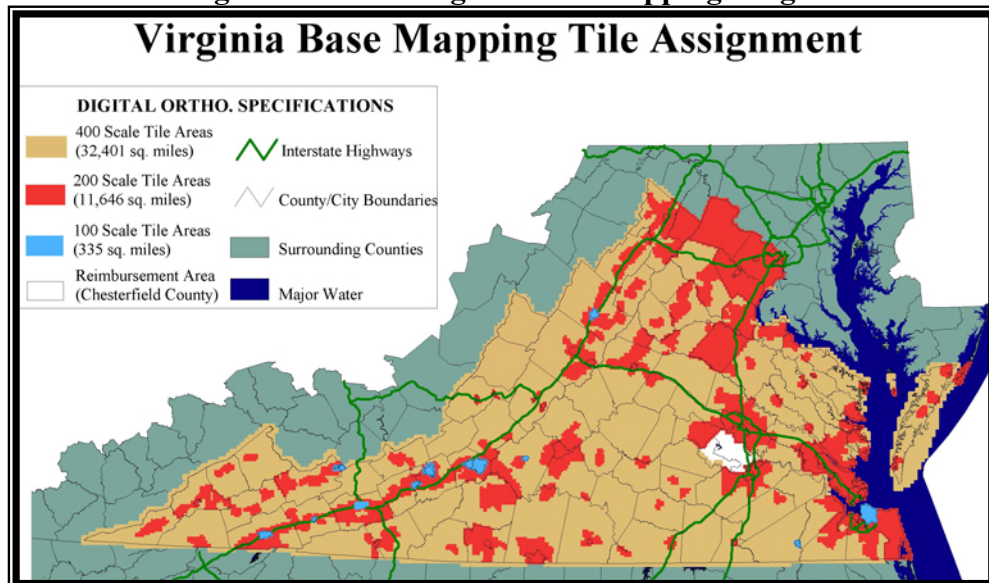
Recommendations

It is anticipated that the VBMP will provide an important catalyst to support the development and maintenance of parcel data across the Commonwealth. A vital component in this process, however, is the development of standards and guidelines to support local efforts to consistently develop value added data products, which includes cadastral information (as well as hydrography, road centerlines, etc.).

K. Summary

The Natural Resources WG has used different evaluation methods to identify the collective data priorities, which will most effectively support the business applications of the Natural Resources WG Organizations. With minor exceptions, the same 10-15 spatial data layers were identified as "critical" in each of the evaluation methods (state mandates, federal mandates, and all applications). The 15 priority data layers that were collectively identified by the Natural Resources WG have also been assessed, according to "application demand" by individual agency (see Appendix H). Furthermore, the needs of the Natural Resources WG are fairly consistent with the spatial data priorities outlined in the Federal Geographic Data Committee's (FGDC) list of *Framework Data Layers*.

The spatial data priorities identified by Natural Resources WG members include all of the FGDC's framework data layers with the exception of orthoimagery, geodetic control, and transportation.[33] It is not surprising that Geodetic Control and Orthoimagery were not identified as high priority layers for the Natural Resources WG. This is because the Natural Resources WG members considered geodetic control and orthoimagery, as raw data sources, and not "value added" data products. Certainly, many of the priority data layers identified by the Natural Resources WG are generated from raw data sources. For example, high resolution digital orthoimagery is used to delineate parcel boundaries and SSURGO soils. Furthermore, the enhancement and processing of the ancillary data that are required to generate high accuracy orthoimagery can also be used to generate new data products (i.e. DEM's, hydrography from breaklines).[34]

Transportation is another FGDC framework data layer. Oddly enough, not only was transportation not included as a high priority data layer, but also none of the Natural Resources WG organizations listed transportation as a data layer to support any of their applications. In retrospect, the Natural Resources WG members agreed that this was an oversight. While the natural resources agencies do not use the transportation network to directly support their modeling applications, they do use this layer as a reference layer to

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[33] There are seven framework datalayers identified by the Federal Geographic Data Committee that are commonly used in GIS applications. The seven framework datalayers include: geodetic control, orthoimagery, elevation, transportation, hydrography, governmental units, and cadastral information
[34]It should also be noted that the development of high resolution digital orthophotography requires geodetic control.

support the generation of maps and output of their models, and for reporting purposes. Some of the natural resources agencies would, for example, use a road file to support address matching (for permitting, etc.) as soon as a reliable and comprehensive file (supported by statewide consistent addressing) is available in the Commonwealth.

X. Continuing the Efforts of the Natural Resources Workgroup

This is an exciting time for GIS applications in Virginia. Local governments are playing greater roles in the development and maintenance of high-resolution data to support their applications. These data sets, in turn, are being increasingly leveraged by state and federal applications. The Virginia Base Mapping Program (VBMP), in conjunction with other statewide efforts, will provide an incredible leveraging opportunity to support local, state and federal applications. Efforts are currently underway to explore leveraging potential at the federal level. VGIN is currently holding discussions with the United States Geologic Survey (USGS), the U.S. Census Bureau, the U.S. Army Corps. of Engineers (USACE), the Federal Emergency Management Agency (FEMA), and the Natural Resources Conservation Service (NRCS).

Sharing Ideas With Other VGIN Workgroups

The Natural Resources WG has been working hard to identify and prioritize their collective needs, and to make formal recommendations to VGIN. These needs will be incorporated with the collective recommendations from the other VGIN workgroups, including the Demographic, Cultural and Infrastructure Workgroup (DECI), Local Government Workgroups, the Technology Workgroup, and the Federal Agency Workgroup.

Ongoing and Future Directions for the Natural Resources Workgroup

The Natural Resources WG recognizes that the GIS "landscape" and the "Application Matrix" will continue to evolve as agencies establish new GIS applications to support their mandates and missions, and as additional or improved spatial data resources become available to support applications. Therefore the Natural Resources WG's responsibilities will be ongoing and iterative.

Currently, Natural Resources WG members are continuing to work on the detailed follow-up surveys. With the recent funding of the VBMP, the Natural Resources WG may also be faced with decisions to explore cost effective opportunities to support the development of high-resolution data layers that months ago, were considered to be too expensive to warrant consideration. It is imperative that this group continues to identify leveraging opportunities between group members, and continue to explore avenues for collaboration and cooperation, especially given existing bugetary constraints.

Appendix A

AGENCY GIS APPLICATION INVENTORY

Format: layer [minimal attributes] <feature type> (scale) - program needs

From DCR:
- confined animals [locations, types, numbers] <points> (map grade GPS) - for TMDLs and NPS assessment.
- failing septic [numbers by watershed, loadings] <tables> (census block level) - for TMDLs and NPS assessment.
- ag BMP installations [lots of info] <points> (map grade GPS) - for Ag BMP cost-share program, TMDL, and NPS assessment.
- next level of watersheds [boundaries, identifiers, water feature contents] <polygons> (1:24,000) - for NPS assessment, watershed prioritization, NWBD.
- urban disturbed acres [acres by watershed, loadings] <tables> (hu summation) - for NPS assessment and urban program evaluations.
- Heritage resources [summations by watershed, rank] <tables> (hu summation) - for watershed prioritization.
- detailed, current, and accurate lu/lc [TMDL classification] <polygons> (1:12,000 or better) - for TMDLs.
- nutrient management sites [lots of info] <points> (map grade GPS) - for nutrient management program, TMDLs, and NPS assessment.
- hiking/biking/canoeing trails [locations, types, access, etc] <points and arcs> (1:24000 or better) – for integration with conservation lands coverage

From DEQ:
- water quality monitoring sites [lots of info] <points> (map grade GPS) - combined w/STORET for many water quality program needs.
- 2002 impaired waters database [lots of info] <arcs and polygons> (detailed descriptions of end points) - for TMDLs, watershed prioritization.
- VPDES sites [facility, level] <points> (map grade GPS) - for watershed planning.

From DOF:
- forest harvesting activities; past 5 years [locations, harvest date] <tables> (hu summations) - for NPS assessment.
- silviculture BMPs [locations, practice] <?> (map grade GPS) - for NPS assessment.

Appendix A
(continued from previous page)

AGENCY GIS APPLICATION INVENTORY

From DMME:
- abandoned mines [locations, ranks] <points> (map grade GPS) - for watershed prioritization and TMDLs.
- orphaned mines [locations, ranks] <points> (map grade GPS) - for watershed prioritization and TMDLs.
- geology [formation, description, etc] <polygons> (1:24000 or better) – for natural heritage inventory and management
- karst regions [locations] <polygons> (1:24000) – for natural heritage inventory and management, project review

From other:
- statewide CIR imagery (5m cells or better) - for CREP and TMDLs.
- statewide lu/lc with better ag/urban classification [classification] <polygons> (1:12,000 or better) - for NPS assessment, natural heritage inventory and conservation, and many other programs.
- water supply sources [locations, use volume, source type] <?> (1:12,000 or better) - for watershed prioritization and watershed planning..
- more detailed hydrology [preferably the NHD atts] <arcs and polygons> (1:24,000 or better) - for CREP, TMDLs, watershed planning, natural heritage inventory, and mapping needs.
- statewide marina locations [identifier, clean marina participant, gas, pump-out, size] <points> (1:24,000 or better) – for trib strategies and clean marina program.

From multiple agencies (CBF, DHR, VOF, etc)
- land holdings information [locations, acreage, yr acquired, type] <tabular and polygons> (1:24000 or better) – for conservation lands coverage and Chesapeake Bay C2K assessments.

Appendix B: The Application Matrix

If the Natural Resources Application Matrix is not included in Section 4 of this report (if distributed in hardcopy), it can be accessed, viewed and downloaded from VGIN's Web Page:

[http:// to be announced.](http://)

If the Natural Resources Work Group Summary Paper was acquired in a digital format, the matrix may also be included as a separate attachment (Adobe PDF).

Appendix C: Agency Follow-up Survey Example

Agency/Application: DGIF / FISHERIES MANAGEMENT + STOCKING ACTIVITIES

1. **Basic Description of Application (short paragraph):**
    The Virginia Department of Game and Inland Fisheries is responsible for the management of statewide warm and cold water fisheries and providing angling opportunities for Virginia's citizens. Effective management occurs through regulation, research, resource planning, population/stock assessment, habitat assessment and improvement, aquaculture and stocking. This information and subsequent management decisions are intended to provide angling opportunities for the citizens of the Commonwealth and to maintain optimal populations of Virginia's fish species.

2. **Is this application mandated (choose one):**
    - ☐ Feds
    - ☒ State
    - ☐ Other (explain):

3. **Could your application be improved if better spatial data was available (choose one)?**
    - ☐ No
    - ☒ Yes

4. **Does this application have a report or analysis deadline, or a regular reporting schedule (choose one)?**
    - ☐ No
    - ☒ Yes: If "Yes", how often (choose one): Annually

4. **Identify the data layers that are currently available (i.e. you currently use) to support your application, and choose the scales and coverage extents that most closely describe each layer:** *Note: Data layer names have already been added, according to 'the matrix submissions'. Feel free to add additional / missing data layers, however, do not include raw imagery products data products [i.e. Landsat, DOQQ's, etc]. All "value added" data products [i.e. land use, land cover, topography] that are derived from imagery products, and that are associated with this application should be included.*

#	Layer (Name)	Existing Scale (select one)	Ideal Scale (in a perfect world)	Coverage/Extent (dropdown menu)
1	Wetlands (24K)	Scale: 1:24,000	Scale: 1:24,000	Not statewide-selected areas
2	Land Cover	Scale: 1:24,000	Scale: 1:24,000	Statewide-Contiguous
3	Land Use	Scale:	Scale:	
4	Watershed Boundaries	Scale: 1:24,000	Scale: 1:24,000	Statewide-Contiguous
5	Detailed Hydro	Scale:	Scale: 1:24,000	Statewide-Contiguous
6	Hydro	Scale: 1:100,000	Scale: 1:24,000	Statewide-Contiguous
7	Boat Ramps (DGIF-owned)	Scale: 1:24,000	Scale: 1:24,000	Statewide-Contiguous
8	Disturbed Urban Areas	Scale:	Scale: 1:24,000	Statewide-Contiguous
9	Natural Heritage Resources	Scale:	Scale: 1:24,000	Statewide-Contiguous
10	State Parks	Scale: 1:100,000	Scale: 1:24,000	Statewide-Contiguous
11	Nutrient Mgt. Sites	Scale:	Scale: 1:24,000	Statewide-Contiguous
12	VPDES Sites	Scale:	Scale: 1:24,000	Statewide-Contiguous
13	Water Quality Monitoring	Scale:	Scale: 1:24,000	Statewide-Contiguous
14	Wildlife Management Areas (DGIF)	Scale: 1:24,000	Scale: 1:24,000	Statewide-Contiguous
15	Impaired Waters	Scale:	Scale: 1:24,000	Statewide-Contiguous
16	Anadromous Fish Waters	Scale: 1:100,000	Scale: 1:24,000	Statewide-Contiguous
17	Endang./threatened species waters	Scale: 1:100,000	Scale: 1:24,000	Statewide-Contiguous
18	Trout Streams	Scale: 1:100,000	Scale: 1:24,000	Statewide-Contiguous
19	Endangered/threatened species locations	Scale: 1:24,000	Scale: 1:24,000	Statewide-Contiguous
20	Species Collection	Scale: 1:24,000	Scale: 1:24,000	Statewide-Contiguous
21	Confined Animals	Scale:	Scale:	
22	Failing Septic	Scale:	Scale:	
23	*Jurisdictional boundaries*	Scale: < 1:100,000	Scale: 1:24,000	Statewide-Contiguous
24	*Riparian buffers*	Scale:	Scale: 1:24,000	Statewide-Contiguous
25	*Shoreline feature*	Scale:	Scale: 1:24,000	Statewide-Contiguous
26	*Marina locations*	Scale:	Scale: 1:24,000	Statewide-Contiguous
27	*Submerged Aquatic Veg.*	Scale:	Scale: 1:24,000	Statewide-Contiguous
28	*Aerial Pesticide Sprays*	Scale:	Scale: 1:24,000	Statewide-Contiguous
29	*Karst areas*	Scale:	Scale: 1:24,000	Statewide-Contiguous
30		Scale:	Scale:	

6. Identify any data layers that are <u>not currently available</u> to support your application, but that could support this application if they were available.
Note: do not include raw imagery products data products [i.e. Landsat, DOQ's, etc]. Do include "value added" data products [i.e. land use, land cover, topography] that may be derived from raw imagery.

#	Layer	Usable Scale (not ideal, but it would work)	Ideal Scale (in a perfect world)	Coverage/Extent (dropdown menu)
1	*Land Ownership*	Scale: 1:24,000	Scale: 1:24,000	Statewide-Contiguous
2	National Waterbody Dataset (NWBD)	Scale: 1:100,000	Scale: 1:24,000	Statewide-Contiguous
3	*Bathymetry (general 1:24K)*	Scale: 1:24,000	Scale: 1:24,000	Statewide-Contiguous
4	*Geology*	Scale: < 1:100,000	Scale: 1:24,000	Statewide-Contiguous
5	*Flood Plain Boundaries*	Scale: 1:100,000	Scale: 1:24,000	Statewide-Contiguous
6	*Seamless DEM*	Scale: 1:100,000	Scale: 1:24,000	Statewide-Contiguous
7	*non-DGIF public boat ramps*	Scale: 1:100,000	Scale: 1:24,000	Statewide-Contiguous
8		Scale:	Scale:	
9		Scale:	Scale:	
10		Scale:	Scale:	

Appendix D

Application List and Themes from the Application Matrix[35]

#	Mandated	Agency	Application
			Water Quality Assessment
1	Fed	**DCR**	**TMDL**
2	Other	**DCR**	**Nonpoint Source Pollution**
3	--	**DCR**	**Ag BMP**
4	State	**DCR**	**Nutrient Mgt Prog**
5	n/a	**DCR**	**Clean Marina**
6	Fed	**CBLAD**	**TMDL's**
7	n/a	**CBLAD**	**NPS Assessment**
8	State	**CBLAD**	**Ag BMP Cost Share**
9	State	**CBLAD**	**Nutrient Mgmt. Program**
10	State	**CBLAD**	**Misc. Water Quality Monitoring**
11	n/a	**DOF**	**Water Quality**
			Watershed Management/Protection/Assessmnt
12	n/a	**DCR**	**Watershed Planning**
13	State	**DOF**	**Tax Credit**
14	State	**DCR**	**Conservation Reserv. Enhancemt Prog.**
15	n/a	**VIMS**	**Shoreline Mapping**
16	Other	**VIMS**	**Shoreline Erosion/Accretion Trends**
17	Other	**CBLAD**	**Watershed Planning**
18	Other	**VIMS**	**Watershed Mgmt**
19	n/a	**CBLAD**	**Watershed Prioritization**
20	Other	**DCR**	**Watershed Priorities**
21	Other	**VIMS**	**Shoreline Situation Report Series**
			Habitat Management
22	--	**DOF**	**Forest Health**
23	--	**DOF**	**Forest Cover Monitoring**
24	Other	**VIMS**	**Riparian Buffer Targeting**
25	Other	**VIMS**	**Status and Trends in Wetland Community Structure**
26	Other	**VIMS**	**Acquatic Habitat Assessment**
27	n/a	**VIMS**	**SAV Assessment & Monitoring**
28	n/a	**VIMS**	**Nearshore Use Conflict Analysis**
29	State	**VMRC**	**Public/Leased Oyster Ground Surveys**
30	State	**VMRC**	**Oyster Beds / Reefs**
31	State	**DCR**	**Natural Area Preserves**

(Continued next page)

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[35] Application themes are highlighted in brown. On the Application Matrix, the applications and application themes are actually located on the X-Axis (across the top of the Application Matrix).

Biodiversity + Species Protection			
32	Other	**VIMS**	**Invasive Species Distribution**
33	--	**DGIF**	**Aquatic GAP**
34	State	**DGIF**	**Fisheries Mgmt/Stocking Activities**
35	n/a	**DGIF**	**Watchable Wildlife Activities**
36	n/a	**DGIF**	**Game Species Mgmt**
37	n/a	**DGIF**	**Research Management Activities**
38	n/a	**DGIF**	**VA GAP**
39	State	**DCR**	**Heritage Data Management System**
Regulatory Review/Assessm't			
40	n/a	**DEQ**	**Underground Storage Tank**
41	n/a	**DEQ**	**Waste Tire Piles - Cleanup Status**
42	n/a	**DEQ**	**Landfills - Open,Slated for Close, Lined**
43	Fed/State	**VIMS**	**Tidal Wetlands Impact Assessment**
44	State	**VMRC**	**Tidal bottomland/wetland/dune mgmt**
45	Fed/State	**DGIF**	**Environmental Reviews**
46	State	**DCR**	**Environmental Reviews**
Land Mangement and Planning			
47	--	**DOF**	**Forest Protection**
48	--	**DOF**	**Forest Resource Assessment**
49	--	**DOF**	**Forest Inventory Analysis**
50	--	**DOF**	**Forest Management**
51	n/a	**DCR**	**Urban Prog. Evals**
52	--	**DOF**	**Rural/Urban interface analysis**
53	State	**CBLAD**	**Storm Water Management**
54	n/a	**CBLAD**	**Conservation Reserv. Enhancemt Prog.**
55	State	**DGIF**	**Land Management / Acquisition**
56	n/a	**VIMS?**	**Nearshore Use Conflict**
56	--	**DCR**	**Dataset Development - Public Land Holdings**
Applied Research			
57	--	**DOF**	**Forest Fire Risk analysis**
58	--	**DOF**	**Forest Fuel Model**
59	n/a	**VIMS**	**Storm Surge/Sea Level Rise Modeling**
Other			
60	--	**DOF**	**Reference Data**
61	Fed/State	**DGIF**	**Survey & Research**
62	State	**DGIF**	**Info Requests**

Appendix E:
1:24,000 Outstanding Hydro DLG's

#	Quad Name	State	DMME DWG's
1	Abingdon	VA	YES
2	Bastian	VA	n/a
3	Ben Hur	VA	YES
4	Big Stone Gap	VA	YES
5	Blountville	VA/TN	n/a
6	Bluefield	VA/WV	YES
7	Bristol	VA/TN	n/a
8	Broadford	VA	n/a
9	Brumley	VA	YES
10	Carbo	VA	YES
11	Chatham Hill	VA	n/a
12	Chilhowie	VA	n/a
13	Church Hill	VA/TN	n/a
14	Clinchport	VA	YES
15	Cove Creek	VA	YES
16	Damascus	VA	n/a
17	Duffield	VA	YES
18	Dungannon	VA	YES
19	East Stone Gap	VA	YES
20	Elk Garden	VA	YES
21	Fort Blackmore	VA	YES
22	GateCity	VA	YES
23	Glade Spring	VA	n/a
24	Hansonville	VA	YES
25	Hayters Gap	VA	n/a
26	Hilton	VA	YES
27	Holston Valley	VA/TN	n/a
28	Honaker	VA	YES
29	Hutchinson Rock	VA	YES

#	Quad Name	State	DMME DWG's
30	Indian Spring	VA/TN	n/a
31	Ironto	VA	n/a
32	Kingsport	VA/TN	n/a
33	Konnarock	VA	n/a
34	Kylesford	VA/TN	YES*
35	Laurel Bloomery	VA/TN	n/a
36	Lebanon	VA	YES
37	Lindside	VA/WV	n/a
38	Looneysgap	VA/TN	YES*
39	Marion	VA	n/a
40	Mechanicsburg	VA	n/a
41	Mendota	VA	YES
42	Moll Creek	VA	YES
43	Narrows	VA	n/a
44	Nebo	VA	n/a
45	Norton	VA	YES
46	Oakvale	VA/WV	n/a
47	Pearisburg	VA	n/a
48	Plum Grove	VA/TN	YES*
49	Pounding Mill	VA	YES
50	Princeton	VA/WV	n/a
51	Richlands	VA	YES
52	Rocky Gap	VA	n/a
53	Saltville	VA	n/a
54	Shady Valley	VA/TN	n/a
55	Sneedville	VA	YES*
56	Stickleyville	VA	YES
57	Tazewell South	VA	YES
58	Wallace	VA	n/a
59	Wyndale	VA	n/a

Appendix F

Missing NWI Quads in Virginia

#	USGS 100K Quad Name	NWI/USGS 24K Quad. Name	Photo Date
1	Washington NW	Brandy Station	03/77
2	Washington NW	Gainesville	03/77
3	Washington NW	Independent Hill	03/77
4	Washington NW	Jeffersonton	03/77
5	Washington NW	Middleburg	03/77
6	Washington NW	Nokesville	03/77
7	Washington NW	Occoquan	03/77
8	Washington NW	Orlean	03/77
9	Washington NW	Remington	03/77
10	Washington NW	Somerville	03/77
11	Washington NW	Thoroughfare Gap	03/77
12	Washington NW	Upperville	03/77
13	Washington NW	Warrenton	03/77

Appendix G

LIST of Digital SSURGO Soil Data Available in Virginia

#	FIPS	County	Data Publication Date
1	VA001	ACCOMACK COUNTY	4/27/1999
2	VA003	ALBEMARLE COUNTY	12/28/2000
3	VA007	AMELIA COUNTY	8/9/1999
4	VA007	AMELIA COUNTY	1996
5	VA011	APPOMATTOX COUNTY	1/12/1998
6	VA015	AUGUSTA COUNTY	5/30/2000
7	VA019	BEDFORD COUNTY	9/14/1998
8	VA023	BOTETOURT COUNTY	1/11/2001
9	VA033	CAROLINE COUNTY	1997
10	VA036	CHARLES CITY COUNTY	8/16/1999
11	VA036	CHARLES CITY COUNTY	1995
12	VA041	CHESTERFIELD COUNTY	2/10/1998
13	VA053	DINWIDDIE AREA	1997
14	VA057	ESSEX COUNTY	1997
15	VA069	FREDERICK COUNTY	3/11/1999
16	VA073	GLOUCESTER COUNTY	6/5/2000
17	VA075	GOOCHLAND COUNTY	2/5/1998
18	VA081	GREENSVILLE COUNTY	11/28/2000
19	VA085	HANOVER COUNTY	1/13/2000
20	VA087	HENRICO COUNTY	1/20/1999
21	VA089	HENRY COUNTY	8/18/1999
22	VA089	HENRY COUNTY	1996
23	VA093	ISLE OF WIGHT COUNTY	8/31/1999
24	VA097	KING AND QUEEN COUNTY	1997
25	VA101	KING WILLIAM COUNTY	8/18/1999
26	VA101	KING WILLIAM COUNTY	1995
27	VA105	LEE COUNTY	3/25/1999
28	VA109	LOUISA COUNTY	1/5/2001
29	VA111	LUNENBURG COUNTY	9/20/2000
30	VA113	MADISON COUNTY	1/18/2002
31	VA113	MADISON COUNTY	11/5/2001
32	VA113	MADISON COUNTY	7/26/2001
33	VA117	MECKLENBURG COUNTY	1997

#	FIPS	County	Data Publication Date
34	VA119	MIDDLESEX COUNTY	12/9/1999
35	VA121	MONTGOMERY COUNTY	4/20/2000
36	VA125	NELSON COUNTY	8/18/1999
37	VA125	NELSON COUNTY	1995
38	VA127	NEW KENT COUNTY	10/5/1998
39	VA131	NORTHAMPTON COUNTY	11/30/1998
40	VA133	NORTHUMBERLAND & LANCASTER COUNTIES	12/20/1999
41	VA139	PAGE COUNTY	8/16/1999
42	VA139	PAGE COUNTY	1995
43	VA143	PITTSYLVANIA COUNTY AND CITY OF DANVILLE	8/18/1999
44	VA143	PITTSYLVANIA COUNTY AND CITY OF DANVILLE	1995
45	VA145	POWHATAN COUNTY	1997
46	VA149	PRINCE GEORGE COUNTY	3/21/2000
47	VA153	PRINCE WILLIAM COUNTY	8/1/2000
48	VA159	RICHMOND COUNTY	1997
49	VA161	ROANOKE COUNTY AND THE CITIES OF ROANOKE AND SALEM	8/23/1999
50	VA161	ROANOKE COUNTY AND THE CITIES OF ROANOKE AND SALEM	1995
51	VA165	ROCKINGHAM COUNTY	2/10/1998
52	VA171	SHENANDOAH COUNTY	3/23/1998
53	VA173	SMYTH COUNTY	8/23/1999
54	VA173	SMYTH COUNTY	1996
55	VA175	SOUTHAMPTON COUNTY	7/23/1997
56	VA177	SPOTSYLVANIA COUNTY	1/20/1998
57	VA179	STAFFORD AND KING GEORGE COUNTIES	1998
58	VA181	SURRY COUNTY	6/30/1999
59	VA185	TAZEWELL COUNTY	2/10/1998
60	VA187	WARREN COUNTY	3/8/2001
61	VA191	WASHINGTON COUNTY	1/21/2000
62	VA193	WESTMORELAND COUNTY	11/19/1997
63	VA715	TIDEWATER CITIES AND CITY OF RICHMOND	8/1/1997
64	VA800	CITY OF SUFFOLK	2/10/1999
65	VA810	CITY OF VIRGINIA BEACH	6/5/1998

Appendix H
(pp. 54-68)

Application and Priority Data Matrix Summaries for the Individual Natural Resources Work Group Organizations

Chesapeake Bay Local Assistance Department
Department of Conservation and Recreation
Department of Environmental Quality
Virginia Marine Resources Commission
Department of Forestry
Department of Game and Inland Fisheries
Virginia Institute of Marine Sciences

Chesapeake Bay Local Assistance Department (CBLAD)

Application and Data Matrix Summary for 15 Priority Data Layers Based on total Demand

Data Priority per Total NR Demand	Data Layers (listed by overall or total "demand")	Application Mandate[36]:									Data Layer's value to CBLAD Applications
		F		S	S	S	O		S		
		TMDL's	NPS Assessment	Ag BMP Cost Share	Nutrient Mgmt. Program	Misc. Water Quality Monitoring	Watershed Planning	Watershed Prioritization	Storm Water Management	Conservation Reserv. Enhancemt Prog.	
1	Hydrography[37]	X	X		X	X		X	X	O	8/9
2	Watershed Boundaries	X	X		X		X	X		X	6/9
T-3	Land Use	X	X				X	X	X	X	6/9
T-3	Land Cover	X	X				X	X	X	X	6/9
5	Wetlands	X			X				X	X	4/9
6	Elevation (Topography/contours)	X			X			X	X	X	5/9
7	Jurisdictional Boundaries										0/9
T-8	Riparian Forest Buffers		X						X	X	3/9
T-8	Soils	X								X	2/9
10	Census Data			X				X	X		3/9
11	Land Ownership									X	1/9
12	Parcel Boundaries									X	1/9
13	Flood Plain Boundaries						X		X		2/9
14	Disturbed Urban Areas	X	X				X	X	X		5/9
15	State Forests/DOF Lands										0/9
	# Priority Data Layers / Application	8	6	1	4	1	5	7	9	10	
	Total # Data Layers / Application	15	16	3	7	3	7	13	9	12	

[36] Key: F=Federal mandate | S=State mandate | O=Other | -- = supports agency mission (but no specific mandate) | gray box = no information provided

[37] Includes both 1:24,000 and 1:100,000. "O" is used to signify that both scales of hydrology are used to support an application.

This table (above) provides a summary of CBLAD's data applications relative to the 15 priority data layers as identified by the Natural Resources WG. CBLAD's priority data needs are fairly consistent with the collective needs of the Natural Resources WG. Hydrography, which received highest priority among the other Natural Resources WG Organizations, is also a priority data layer for CBLAD, as it supports the highest number of applications (7 of 9). Land Use, Land Cover, Watershed Boundaries, Elevation, and Disturbed Urban Areas are also identified as high priorities for CBLAD, based on "application demand".

Census Data, Jurisdictional Boundaries, Parcel Boundaries, Land Ownership, State Forests, Soils, Jurisdictional Boundaries, and Flood Plain boundaries received a high collective ranking by the Natural Resources WG Organizations. However, these data layers are lower priority data layers for CBLAD, as they support fewer than 3 applications.

Other data layers (and the number of associated CBLAD Applications) that were identified as high priority layers (as defined by "demand") by CBLAD, but that were not collectively identified as a high priority by the Natural Resources WG include:

- Agriculture BMP Installations

Department of Conservation and Recreation (DCR)

Application and Data Matrix Summary for 15 Priority Data Layers Based on total Demand

Data Priority per Total NR Demand	Application Mandate[38]:	TMDL	Nonpoint Source Pollution	Ag BMP	Nutrient Mgt Prog	Clean Marina	Watershed Planning	Conservation Reserv. Enhancemt Prog.	Watershed Priorities	Natural Area Preserves	Heritage Data Management System	Environmental Reviews	Urban Prog. Evals	Dataset Development - Public Land Holdings	Data Layer's Value for DCR Applications
				--	S			S	O	S	S	S		--	
	Data Layers (listed by overall or total "demand")														
1	Hydrography[39]	X	O	X	O	X	O	O	X	X	X	X		O	12/13
2	Watershed Boundaries	X	X	X	X		X	X	X					X	8/13
T-3	Land Use	X	X				X	X	X					X	6/13
T-3	Land Cover	X	X				X	X	X					X	6/13
5	Wetlands						X	X	X	X				X	5/13
6	Elevation (Topography/contours)	X					X			X	X	X		X	6/13
7	Jurisdictional Boundaries			X			X			X	X	X	X		6/13
T-8	Riparian Forest Buffers						X	X	X					X	4/13
T-8	Soils	X	X				X	X		X	X	X		X	8/13
10	Census Data						X			X				X	3/13
11	Land Ownership								X					X	2/13
12	Parcel Boundaries			X	X		X	X						X	5/13
13	Flood Plain Boundaries						X							X	2/13
14	Disturbed Urban Areas	X	X				X	X	X					X	6/13
15	State Forests/DOF Lands													X	1/13
	# Priority Data Layers / Application	7	6	4	3	1	14	10	7	6	4	4	1	14	
	Total # Data Layers / Application	18	15	6	7	2	37	12	26	14	12	13	2	42	

[38] Key: F=Federal mandate | S=State mandate | O=Other | -- = supports agency mission (but no specific mandate) | gray box = no information provided

[39] Includes both 1:24,000 and 1:100,000. "O" is used to signify that both scales of hydrology are used to support an application.

This table (above) provides a summary of DCR's 13 operational GIS applications relative to the 15 priority data layers as identified by the Natural Resources WG. DCR's priority data needs are fairly consistent with the collective needs of the Natural Resources WG. Hydrography (which received highest priority among the Natural Resources WG organizations) is also a high priority data layer for DCR, as it supports 12 of 13 GIS applications. Watershed boundaries and soils are also identified as high priorities for DCR, based on "application demand".

State Forests, Flood Plain Boundaries, Land Ownership, and Census Data received high collective rankings by the Natural Resources WG. However, these data layers are lower priority data layers for DCR, as they only support 1, 2, or 3 operational applications.

Other data layers (and the number of associated DCR applications) that were identified as high priority layers (as defined by "demand") by DCR, but that were not collectively identified as a high priority by the Natural Resources WG include:

- Ag BMP Installations (7)
- Confined Animals (6)
- Nutrient Mgt. Sites (5)

Department of Environmental Quality (DEQ)

Application and Data Matrix Summary for 15 Priority Data Layers Based on total Demand

Data Priority per Total NR Demand	Data Layers (listed by overall or total "demand")	Underground Storage Tank	Waste Tire Piles – Clean up status	Landfills – Open, slated, closed, lined	Data Layer's Value to DEQ Applications
	Application Mandate[40]:				
1	Hydrography[41]				0/3
2	Watershed Boundaries				0/3
T-3	Land Use				0/3
T-3	Land Cover				0/3
5	Wetlands				0/3
6	Elevation (Topography/contours)				0/3
7	Jurisdictional Boundaries	X	X	X	3/3
T-8	Riparian Forest Buffers				0/3
T-8	Soils				0/3
10	Census Data	X			1/3
11	Land Ownership			X	1/3
12	Parcel Boundaries				0/3
13	Flood Plain Boundaries				0/3
14	Disturbed Urban Areas				0/3
15	State Forests/DOF Lands				0/3
	# Priority Data Layers / Application	2	1	2	
	Total # Data Layers / Application	4	3	4	

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[40] Key: F=Federal mandate | S=State mandate | O=Other | -- = supports agency mission (but no specific mandate) | gray box = no information provided.

[41] Includes both 1:24,000 and 1:100,000. "**O"** is used to signify that both scales of hydrology are used to support an application.

This table (above) provides a summary of DEQ's data applications relative to the 15 priority data layers as identified by the Natural Resources WG. Based on the information provided, DEQ's priority data needs are somewhat consistent with the collective needs of the Natural Resources WG. Jurisdictional Boundaries were identified as DEQ's highest priority data layer, as this data layer was associated with all three of DEQ's applications. Census Data and Land Ownership were also identified as high priority data layers by both DEQ and the Natural Resources WG. Of the 11 data layers that DEQ uses to support its applications, 5 of them are associated with the Natural Resources Workgroup's high priority data layers. DOQQ's, a raw data imagery source, is also used to support all 3 of DEQ's applications.

Other data layers (and the number of associated DEQ Applications) that were identified as high priority layers (as defined by "application demand") by DEQ, but that were not collectively identified as a high priority by the Natural Resources WG include:

- Waste Tire Piles (1)
- Landfills (1)
- Petroleum Storage Tanks (1)

Department of Game and Inland Fisheries (DGIF)

Application and Data Matrix Summary for 15 Priority Data Layers Based on Total Demand

Data Priority per NR Total Demand	Data Layers (listed by overall or total "demand")	Aquatic GAP (--)	Fisheries Mgmt/Stocking Activities (S)	Watchable Wildlife Activities (S)	Game Species Mgmt (F/S)	Research Management Activities (F/S)	VA GAP (O)	Environmental Reviews (F/S)	Land Management / Acquisition (S)	Survey & Research (F/S)	Info Requests (S)	Data Layer's value to DGIF Applications
1	Hydrography[43]	O	O		X		O	X	O			6/10
2	Watershed Boundaries	X	X			X	X		X			5/10
T-3	Land Use	X	X	X	X		X	X	X			7/10
T-3	Land Cover	X	X	X	X		X	X	X			7/10
5	Wetlands	X	X	X	X		X	X	X			7/10
6	Elevation (Topography/contours)	X			X		X		X			4/10
7	Jurisdictional Boundaries	X			X							2/10
T-8	Riparian Forest Buffers	X		X			X	X	X			5/10
T-8	Soils	X			X		X		X			4/10
10	Census Data						X		X			2/10
11	Land Ownership	X	X	X	X		X	X	X			7/10
12	Parcel Boundaries	X				X	X	X				4/10
13	Flood Plain Boundaries	X										1/10
14	Disturbed Urban Areas	X	X				X	X	X			5/10
15	State Forests/DOF Lands	X		X		X	X	X	X			6/10
	# Priority Data Layers / Application:	15	8	6	8	3	14	9	13	0	0	
	Total # Data Layers / Application:	44	24	17	15	10	39	24	42	9	9	

[42]Key: F=Federal mandate | S=State mandate | O=Other | -- = supports the agency mission (but no specific mandate) | gray box = no information provided

[43] Includes both 1:24,000 and 1:100,000. "O" is used to signify that both scales of hydrology are used to support an application.

This table (above) provides a summary of DGIF's data applications relative to the 15 priority data layers as identified by the Natural Resources WG. DGIF's priority data needs are fairly consistent with the collective needs of the Natural Resources WG. Hydrography (which is associated with the highest priority of all the spatial data layers based on "application demand") is also a priority data layer for DGIF, as it supports the highest number of applications. Land Use, Land Cover, Wetlands, and Land Ownership are also identified as high priorities for DGIF.

Census Data, Jurisdictional Boundaries, and Flood Plain boundaries received a high collective ranking by the Natural Resources WG. However, these data layers are lower priority data layers for DGIF (based on application demand), as they only support one or two applications.

Other data layers (and the number of associated DGIF Applications) that were identified as high priority layers (as defined by "demand") by DGIF, but that were not collectively identified as a high priority by the Natural Resources WG include:

- Endangered/Threatened Species Waters (9)
- Endangered/Threatened Species Locations (8)
- Wildlife Management Areas (8)
- Species Collection (8)
- Colonial Waterbird Nesting Sites(7)
- Trout Streams (7)

Department of Forestry (DOF)
Application and Data Matrix Summary for 15 Priority Data Layers
Based on total Demand

Data Priority per Total NR Demand	Data Layers (listed by overall or total "demand")	Water Quality	Tax Credit	Forest Health	Forest Cover Monitoring	Forest Protection	Forest Resource Assessment	Forest Inventory Analysis	Forest Management	Rural/Urban interface analysis	Forest Fire Risk analysis	Forest Fuel Model	Reference Data	Data Layer's Value for DOF Applications
	Application Mandate[44]:	(gray)	S	--	--	--	--	--	--	--	--	--	--	
1	Hydrography[45]	O	O	O		O		O	O	O	O	O		9/12
2	Watershed Boundaries		X	X	X	X	X	X	X	X	X			9/12
T-3	Land Use	X		X	X	X	X	X	X		X			8/12
T-3	Land Cover	X		X	X	X	X	X	X		X			8/12
5	Wetlands	X		X	X			X	X	X				6/12
6	Elevation (Topography/contours)	X	X	X	X	X			X	X	X	X		9/12
7	Jurisdictional Boundaries	X	X	X	X			X	X	X	X	X		9/12
T-8	Riparian Forest Buffers	X	X	X	X				X	X				6/12
T-8	Soils	X		X	X				X					4/12
10	Census Data	X		X	X	X	X	X		X	X			8/12
11	Land Ownership			X	X	X			X					4/12
12	Parcel Boundaries	X	X	X	X				X	X				6/12
13	Flood Plain Boundaries	X		X	X				X	X				5/12
14	Disturbed Urban Areas													0/12
15	State Forests/DOF Lands	X		X	X	X	X	X	X		X			8/12
	# Priority Data Layers / Application	13	7	15	13	9	6	9	14	10	9	2	0	
	Total # Data Layers / Application	35	8	37	25	30	14	18	34	24	25	3	3	

[44] Key: F=Federal mandate | S=State mandate | O=Other | -- = supports agency mission (but no specific mandate) | gray box = no information provided

[45] Includes both 1:24,000 and 1:100,000. "O" is used to signify that both scales of hydrology are used to support an application.

This table (above) provides a summary of DOF's 12 operational GIS applications relative to the 15 priority data layers as identified by the Natural Resources WG. DOF's priority data needs are fairly consistent with the collective needs of the Natural Resources WG. Hydrography (which received highest priority among the Natural Resources WG organizations) is also a high priority data layer for DOF, as it supports 9 of 12 GIS applications. Watershed Boundaries, State Forests, Land Use, Land Cover, Census Data, Elevation and Jurisdictional Boundaries, are also identified as high priorities for DOF, based on "application demand".

The Disturbed Urban Areas layer received high collective rankings by the Natural Resources WG. However, this data layer is a lower priority data layer for DOF, as it does not support any existing operational applications.

Other data layers (and the number of associated DOF Applications) that were identified as high priority layers by DOF (as defined by "application demand"), but that were not collectively identified as a high priority by the Natural Resources WG include:

- Forest Harvest Activities (9)
- Unreported Timber Harvests (9)
- Forest/Non-Forest cover (9)
- Replant Areas (10)

Virginia Institute of Marine Science (VIMS)
Application and Data Matrix Summary for 15 Priority Data Layers
Based on total Demand

Data Priority per Total NR Demand	Data Layers (listed by overall or total "demand")	Shoreline Mapping	Shoreline Erosion/Accretion Trends	Watershed Mgmt	Shoreline Situation Report Series	Riparian Buffer Targeting	Status and Trends in Wetland Community Structure	Aquatic Habitat Assessment	SAV Assessment & Monitoring	Nearshore Use Conflict Analysis	Invasive Species Distribution	Tidal Wetlands Impact Assessment	Storm Surge/Sea Level Rise Modeling	Data Layer's value to VIMS Applications
	Application Mandate[46]:		O	O	O	O	O	O			O	F/S		
1	Hydrography[47]	O	O	O	X	O	X	O	X	O	O	O	O	13/13
2	Watershed Boundaries	X		X	X	X	X	X		X	X	X	X	10/13
T-3	Land Use			X	X	X	X	X		X	X	X	X	9/13
T-3	Land Cover			X	X	X	X	X		X	X	X	X	9/13
5	Wetlands			X	X	X	X	X	X	X	X	X	X	10/13
6	Elevation (Topography/contours)		X	X	X	X	X	X			X	X	X	9/13
7	Jurisdictional Boundaries	X	X	X	X	X				X	X	X	X	9/13
T-8	Riparian Forest Buffers			X	X	X		X			X	X	X	7/13
T-8	Soils			X	X	X	X	X			X	X	X	8/13
10	Census Data			X	X	X	X					X	X	6/13
11	Land Ownership			X	X	X	X	X				X	X	8/13
12	Parcel Boundaries		X		X	X	X					X	X	6/13
13	Flood Plain Boundaries	X	X	X	X	X	X					X	X	8/13
14	Disturbed Urban Areas			X		X					X	X		4/13
15	State Forests/DOF Lands			X		X		X					X	4/13
	# Priority Data Layers / Application	5	8	14	14	15	12	10	2	7	11	15	15	
	Total # Data Layers / Application	10	14	44	23	38	22	36	4	16	26	36	37	

[46] Key: F=Federal mandate | S=State mandate | O=Other | -- = supports agency mission (but no specific mandate) | gray box = no information provided
  gray box = no response

[47] Includes both 1:24,000 and 1:100,000. "O" is used to signify that both scales of hydrology are used to support an application.

This table (above) provides a summary of VIMS's data applications relative to the 15 priority data layers as identified by the Natural Resources WG. VIMS's priority data needs are very consistent with the overall priorities of the Natural Resources WG. Hydrography (which received highest priority among the Natural Resources WG Organizations) is a high priority data layer for VIMS, as it supports all of VIMS's applications. Watershed Boundaries, Land Use, Land Cover, Wetlands, and Elevation are also identified as high priorities for both VIMS and the Natural Resources WG (based on application demand).

Disturbed Urban Areas and State Forests received a high collective ranking by the Natural Resources WG. However, these data layers are lower priority data layers for VIMS, as they support 4 of VIMS's 13 GIS applications.

Other data layers (and the number of associated VIMS applications) that were identified as high priority layers by VIMS (as defined by "application demand"), but that were not collectively identified as a high priority by the Natural Resources WG include:

- Bottom Type (sand, mud, etc.) (7)
- Bathymetry(Shallow Water) (11)
- Bathymetry (General 24K) (9)
- Shoreline Position-current (24K) (9)
- Bay Preservation Act Preservation Zones (7)
- Natural Heritage Resources (7)
- Shoreline Feature Identification (10)

Virginia Marine Resources Commission (VMRC)

Application and Data Matrix Summary for 15 Priority Data Layers
Based on total Demand

Data Priority per Total NR Demand	Data Layers (listed by overall or total "demand")	Public/Leased Oyster Ground Surveys	Oyster Beds / Reefs (s)	Tidal bottomland/wetland/dune mgmt (S)	Data Layer's Value to VMRC Applications
	Application Mandate[48]:		s	S	
1	Hydrography[49]	X	X	O	3/3
2	Watershed Boundaries		X		1/3
T-3	Land Use		X		1/3
T-3	Land Cover		X		1/3
5	Wetlands				0/3
6	Elevation (Topography/contours)				0/3
7	Jurisdictional Boundaries		X	X	2/3
T-8	Riparian Forest Buffers			X	1/3
T-8	Soils				0/3
10	Census Data		X		1/3
11	Land Ownership		X		1/3
12	Parcel Boundaries			X	1/3
13	Flood Plain Boundaries		X	X	2/3
14	Disturbed Urban Areas	X			1/3
15	State Forests/DOF Lands				0/3
	# Priority Data Layers / Application	2	8	6	
	Total # Data Layers / Application	4	29	18	

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[48] Key: F=Federal mandate | S=State mandate | O=Other | -- = supports agency mission (but no specific mandate) | gray box = no information provided

[49] Includes both 1:24,000 and 1:100,000. "O" is used to signify that both scales of hydrology are used to support an application.

This table (above) provides a summary of VMRC's data applications relative to the 15 priority data layers as identified by the Natural Resources WG. VMRC's priority data needs are not consistent with the other Natural Resources Workgroup Organizations. VMRC's GIS operational applications are more associated with marine related issues than with land-based applications. This is clearly reflected in VMRC's spatial data needs. Hydrography is one of the higher data priorities for the VMRC, and it is the highest collective data priority (based on demand) of the Natural Resources WG Organizations. Jurisdictional Boundaries, and Floodplain Boundaries were also identified as high priorities for both the VMRC and for the Natural Resources WG.

Wetlands, Elevations, Soils, and State Forests received a high collective ranking by the Natural Resources WG. However, these data layers are lower priority data layers for VMRC, as they do not support any of VMRC's operational applications.

Other data layers (and the number of associated VMRC Applications) that were identified as high priority layers by VMRC (as defined by "application demand"), but that were not collectively identified as a high priority by the Natural Resources WG include:

- Submerged Aquatic Vegetation (2)
- Public/Private Oyster Grounds (3)
- Bay Preservation Act Preservation Zones (2)
- Shellfish Beds (2)
- Marina Locations (2)
- Boat Ramps (DGIF-owned) (2)
- Bathymetry (General 24K) (3)
- Bottom Type (sand, mud, etc.) (2)
- Bathymetry (Shallow Water) (2)
- Shoreline Feature Identification (2)